

EXP.046A



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Yuri Galperin, et al.
Appl. No. : 09/942,983
PCT Filing Date : August 30, 2001
For : METHOD AND APPARATUS
FOR DETERMINING A
PREPAYMENT SCORE FOR AN
INDIVIDUAL APPLICANT
Examiner : Siegfried E. Chencinski
Group Art Unit : 3692

PETITION TO CORRECT INVENTORSHIP UNDER 37 C.F.R. § 1.48

Mail Stop Petition

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

05/01/2008 TL0011 00000003 09942983
02 FC:1464

130.00 OP

Dear Sir:

Applicants hereby petition under 37 C.F.R. § 1.48(a) to correct the inventorship of the above-captioned patent application. In particular, Applicants wish to add the following individual, omitted by error, as an inventor in the above-identified application:

Charles L. Jones III
Residence Address: 4570 Old Post Road, Charlestown, RI 02813-2560
Citizenship: USA

Pursuant to the requirements of 37 C.F.R. § 1.48(a) and M.P.E.P. § 201.03(II), transmitted with this request are:

- (1) A declaration signed by three of the four actual inventors, namely Yuri Galperin, Vladimir Fishman, and William Eginton, pursuant to 37 C.F.R. § 1.63.
- (2) A Consent of Assignee to Correct Inventorship Under 37 C.F.R. § 1.48(a)(5).
- (3) A petition under 37 C.F.R. § 1.183 to waive the requirement of 37 C.F.R. § 1.48(a)(2) that Charles L. Jones III's sign a statement that he was erroneously omitted as an inventor from the application through no deceptive intent on his part.

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- (4) A petition under 37 C.F.R. § 1.47 to accept the declaration executed by three of the four inventors.
- (5) The processing fee set forth in 37 C.F.R. § 1.17(i).

Accordingly, Applicants respectfully request that the present petition should be granted. Please use Customer No. 20,995 for all communications. Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

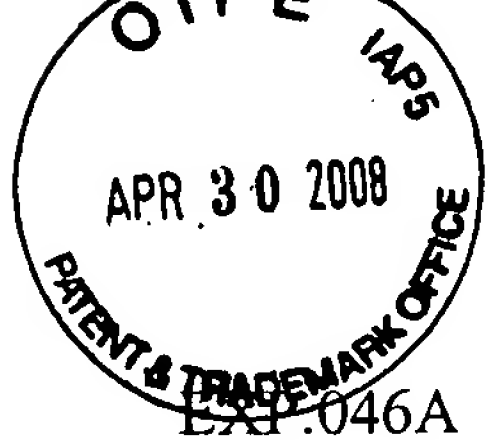
Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 4/28/2008

By: Ted M Cannon
Ted M. Cannon
Registration No. 55,036
Attorney of Record
Customer No. 20,995
(949) 760-0404

5204496



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Yuri Galperin, et al.
Appl. No. : 09/942,983
Filing Date : Augusts 30, 2001
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Examiner : Siegfried E. Chencinski
Group Art Unit : 3692

CONSENT OF ASSIGNEE TO CORRECT INVENTORSHIP UNDER
37 C.F.R. § 1.48(a)(5)

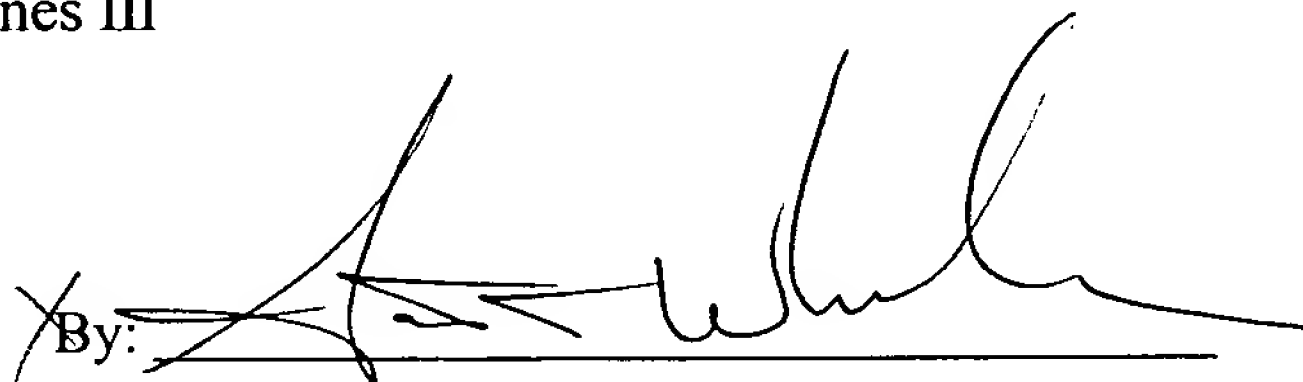
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The undersigned is empowered to act on behalf of the Assignee of the above-referenced application. The Assignee represents that it is the 100% owner of the above-referenced application by virtue of assignments, copies of which are attached hereto. The Assignee hereby consents to the addition of the following inventor to the above-captioned application:

Charles L. Jones III

Dated: August 16, 2007

X By: 

Name: Scott Wheeler

Title: Treasurer

MARKETSWITCH CORPORATION

4093536:kc
080207

EXP.046A



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Applicant	:	Yuri Galperin <i>et al.</i>)	Group Art Unit 3692
)	
App. No.	:	09/942,983)	
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Filed	:	August 30, 2001)	
)	
For	:	METHOD AND APPARATUS FOR)	
		DETERMINING A PREPAYMENT)	
		SCORE FOR AN INDIVIDUAL)	
		APPLICANT)	
)	
Examiner	:	Siegfried E. Chencinski)	
)	

DECLARATION OF TED M. CANNON

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Ted M. Cannon, declare and state:

1. I am a partner in the law firm Knobbe, Martens, Olson & Bear LLP. I am an attorney-of-record in the above-referenced application and am authorized to act in behalf of the assignee.

2. I am informed and believe that Laura Meltzer attempted to contact Charles L. Jones III to obtain his signature on a declaration of inventorship for the patent application and on a statement that he believes he should be named as an inventor in the above-referenced application and that he was omitted as an inventor without deceptive intent on his part, as set forth in the Declaration of Laura Meltzer submitted with Applicants' petitions filed on September 19, 2007.

3. Applicants' petitions filed on September 19, 2007 were dismissed in a decision mailed October 26, 2007.

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Filed : August 30, 2001

4. Yuri Galperin, Vladimir Fishman, and William Eginton have signed the declaration of inventorship. A true and correct copy of the declaration of inventorship signed by Yuri Galperin, Vladimir Fishman, and William Eginton is attached hereto as Exhibit A.

5. Prior to December 17, 2007, I obtained, from the Assignee of the above-referenced application, a mailing address for Charles L. Jones III, as follows:

Charles L. Jones III
4 Anchorage Lane
Marblehead, MA 01945

6. On December 17, 2007, I sent a package via certified mail, return-receipt requested, to Charles L. Jones III at the address listed in paragraph 5, enclosing the following: (a) a copy of the above-referenced patent application, (b) the declaration of inventorship, (c) a Statement of Charles L. Jones III under 37 CFR 1.48(a) stating that Charles L. Jones III was erroneously omitted as an inventor of the above-referenced patent application without deceptive intent on his part, and (d) a letter asking Charles L. Jones III to sign the declaration of inventorship and the Statement of Charles L. Jones III under 37 CFR 1.48(a). Attached as Exhibit B are true and correct copies of the December 17, 2007 letter and the documents enclosed therewith.

7. On December 28, 2007, I received the package of paragraph 5 back from the post office, unopened, and marked as undeliverable due to expiration of a forwarding order. The returned package indicated the following forwarding address for Charles L. Jones III:

Charles L. Jones III
4570 Old Post Road
Charlestown, RI 02813-2560

Attached as Exhibit C is a true and correct copy of the notice from the post office indicating the above forwarding address for Charles L. Jones III.

8. On January 14, 2008 I sent a package via certified mail, return-receipt requested, to Charles L. Jones III at the new address listed in paragraph 7, enclosing the following: (a) a copy of the above-referenced patent application, (b) the declaration of inventorship, (c) a Statement of Charles L. Jones III under 37 CFR 1.48(a) stating that Charles L. Jones III was erroneously omitted as an inventor of the above-referenced patent application without deceptive intent on his part, and (d) a letter asking Charles L. Jones III to sign the declaration of

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inventorship and the Statement of Charles L. Jones III under 37 CFR 1.48(a). Attached as Exhibit D are true and correct copies of the January 14, 2008 letter and the documents enclosed therewith.

9. On January 18, 2008, I received a signed receipt from the post office indicating that the January 14, 2008 letter was delivered to the address of paragraph 7. Attached as Exhibit E is a true and correct copy of the receipt.

10. On March 3, 2008 I again sent a package via certified mail, return-receipt requested, to Charles L. Jones III at the new address listed in paragraph 7, enclosing the following: (a) a copy of the above-referenced patent application, (b) the declaration of inventorship, (c) a Statement of Charles L. Jones III under 37 CFR 1.48(a) stating that Charles L. Jones III was erroneously omitted as an inventor of the above-referenced patent application without deceptive intent on his part, and (d) a letter asking Charles L. Jones III to sign the declaration of inventorship and the Statement of Charles L. Jones III under 37 CFR 1.48(a). Attached as Exhibit F are true and correct copies of the March 3, 2008 letter and the documents enclosed therewith.

11. On March 10, 2008, I received a signed receipt from the post office indicating that the March 3, 2008 letter was delivered to the address of paragraph 7. Attached as Exhibit G is a true and correct copy of the receipt.

12. On April 8, 2008 I again sent a package via certified mail, return-receipt requested, to Charles L. Jones III at the new address listed in paragraph 7, enclosing the following: (a) a copy of the above-referenced patent application, (b) the declaration of inventorship, (c) a Statement of Charles L. Jones III under 37 CFR 1.48(a) stating that Charles L. Jones III was erroneously omitted as an inventor of the above-referenced patent application without deceptive intent on his part, and (d) a letter asking Charles L. Jones III to sign the declaration of inventorship and the Statement of Charles L. Jones III under 37 CFR 1.48(a). Attached as Exhibit H are true and correct copies of the April 8, 2008 letter and the documents enclosed therewith.

13. On April 14, 2008, I received a signed receipt from the post office indicating that the April 8, 2008 letter was delivered to the address of paragraph 7. Attached as Exhibit I is a true and correct copy of the receipt.

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Filed : August 30, 2001

14. Despite diligent effort to obtain Charles L. Jones III's signatures on the inventors' declaration and the Statement of Charles L. Jones III under 37 CFR 1.48(a), I have not received signed documents from Charles L. Jones III. Indeed, I have not received any communication from Charles L. Jones III.

15. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated: 4/28/2008

By: Ted M Cannon
Ted M. Cannon
Attorney-of-record
Reg. No. 55,036

5204480

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature

Date

Residence: 3100 Franklins Way, Oak
VA

Citizenship: USA

Mailing Address: same as above

Page 2

Attorney's Docket No. EXP.046A

Full name of Second inventor: Vladimir Fishman

Inventor's signature 

Date

04/21/08

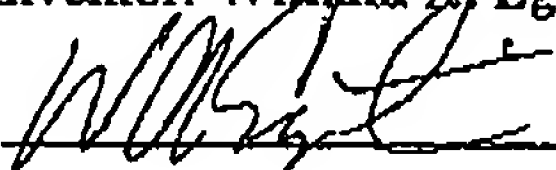
Residence:

339 Main St Farmington, CT 06032

Citizenship: USA

Mailing Address: same as above

Full name of Third inventor: William A. Eginton

Inventor's signature 

Date

1/31/2008

Residence:

211 Cornwall St NW Leesburg VA 20176

Citizenship: USA

Mailing Address: same as above

Full name of Fourth inventor: Charles L. Jones III

Inventor's signature _____

Date _____

Residence: 4570 Old Post Road, Charlestown, RI 02813-2560

Citizenship: USA

Mailing Address: same as above

Send Correspondence To:

KNOBBE, MARTENS, OLSON & BEAR, LLP

Customer No. 20,995

December 17, 2007

VIA CERTIFIED MAIL
No. 7006 0100 0004 5806 4458

Charles L. Jones
4 Anchorage Lane
Marblehead, MA 01945

Re: Patent Application for Prepayment Score
Application No. 09/942983
Our Reference: EXP.046A

Dear Mr. Jones:

As you know, a patent application for your invention entitled METHOD AND APPARATUS FOR DETERMINING LOAN PREPAYMENT SCORE was filed on May 15, 1998 and assigned Application No. 09/078,867, which is now issued Patent No. 6,185,543. You, Yuri Galperin, Vladimir Fishman and William A. Eginton were listed as inventors on this application. A later related application was filed on August 30, 2001 and assigned Serial No. 09/942,983, but did not include you as an inventor. It is our understanding that you were erroneously left off this application through no deceptive intent on your part.

Therefore, we are filing a Petition with the U.S. Patent Office to correct inventorship on the related application. In order to correct inventorship we need you to sign a declaration acknowledging that you and the other three inventors are the inventors of this application. In addition, you need to sign a Statement indicating that you were erroneously left off this application through no deceptive intent on your part ("Statement").

I have enclosed a copy of the application as filed (including the specification, drawings and claims), the Statement and an Assignment of the invention to Marketswitch. Please review the application to confirm that you should be added as an inventor.

Charles L. Jones
December 17, 2007
Page -2-

After your review, please sign and promptly return to me the Declaration, the Statement, and the Assignment in the pre-addressed envelope.

If you have any questions or if you would like to discuss this matter, please do not hesitate to contact me.

Sincerely

A handwritten signature in black ink, appearing to read "Ted M. Cannon". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Ted M. Cannon

Enclosures
4652533:kc/121307

SPECIFICATION

TITLE: METHOD AND APPARATUS FOR DETERMINING A
PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT

RELATED APPLICATIONS

[01] This application claims the benefit of Provisional Application Serial No. 60/228,954, filed August 31, 2000, which is incorporated herein in its entirety.

FIELD OF THE INVENTION

[02] This invention relates generally to receiving applications for and processing of lending transactions. More specifically this invention provides a method and apparatus to assess the prepayment propensity of a borrower in the form of a prepayment "score" to enable assessment of (i) the value of mortgages, second mortgages, home equity loans or other debt instruments for investors, (ii) the value of credit card accounts and balance transfers, (iii) the value of term loans and leases, (iv) the behavior of brokers with respect to churning, (v) the valuation of existing portfolios, (vi) the risk management of institutions that hold debt instruments, and (vii) the pricing of mortgage portfolio servicing contracts.

BACKGROUND OF THE INVENTION

[03] By way of an introductory example, consider the most common of debt instruments, the consumer mortgage. The value of a mortgage depends, in large part, on the duration of the mortgage. At the inception of the mortgage there are broker

fees and various other settlement costs that are charged to the lender. When a mortgage extends for the term of many years, there is an opportunity for the lender to recoup costs of putting a mortgage in place for a given consumer and to make profit on that mortgage. This is particularly important for all business organizations that lend money, but it is particularly important for those mortgage financing organizations which have stockholders and other investors.

[04] When a mortgage loan is paid off early due to refinancing, depending upon how early in the term, the mortgage loan is paid off, there is the possibility that the lending institution can actually take a loss on the particular mortgage. The rate of prepayment depends on a number of objective factors. For example, during times of decreasing mortgage rates, on average, more consumers refinance their home loans than would otherwise occur, in order to obtain a lower monthly payment. However, for a given macroeconomic environment and other measurable, objective factors, each consumer evidences an individual propensity to prepay a loan. This prepayment propensity reflects the consumer's demographic and other objective attributes. A system that can assess such individual prepayment behavior by a consumer in advance of the loan will lead to more profitable loans being made, and hence the enhanced availability of funds for loans to more consumer-borrowers. The present invention therefore may be applied, without limitation, to a) the pricing of mortgages and other debt instruments, b) the valuation of existing portfolios of debt instruments, and c) the risk management of institutions that hold debt instruments.

[05] Additionally, the present invention is not limited to the type of debt instrument or lending transaction to which the prepayment score is useful. The invention includes,

but is not limited to, mortgages (consumer and commercial), second mortgages, refinanced mortgages, consumer loans, commercial loans, asset-backed loans, consumer leases, commercial leases, credit card accounts, credit card balance transfers, debt consolidation loans (term notes, etc.), mortgage-backed securities (i.e., mortgage pass through, CMO's, mortgage-backed bonds, principal-only, interest-only, etc.), and any servicing contract for these lending transactions that performs financially based on the quality (i.e., duration) of the cash flow.

[06] A further element of the present invention is the monitoring and scoring of brokers for these lending transactions. Mortgage brokers deal with both consumer-borrowers and lenders-clients. In order to generate brokerage fees, it is possible for a broker to encourage its consumer-borrowers to refinance their mortgages frequently and prematurely. When this occurs, the mortgage broker generates a fee for the broker, however, early prepayment of the prior mortgage instrument can result in a loss for the lender. Thus the present invention also has the capability to score mortgage broker prepayment behavior.

[07] The behavior of a broker is sometimes not all heinous. Sometimes a consumer, who is particularly attuned to the rise and fall of interest rates, will simply be the one who changes mortgage instruments more frequently than the average consumer. The broker who is scored based upon the prepayment behavior of the consumers that the broker brings to lenders, would like to know the pre-payment propensity for the given consumer. This would be useful so that the mortgage broker can optimize the broker's relationship with its lender-clients by only bringing consumer-borrowers who have a low prepayment propensity.

[08] Therefore, lenders and brokers badly need the ability to better measure prepayment behavior in advance of incurring marketing or underwriting charges; these expenses are too great to absorb blindly on behalf of consumers with poor prepayment propensities. Indeed, a beneficial use of the invention would be in managing the initial marketing effort itself. For example, only those customers who can be shown to score favorably for prepayment behavior might receive a solicitation for a mortgage product A. Consumers who are revealed to represent a substantial prepayment risk may be offered a more suitable mortgage product B, reflecting the increased risk. In this way, enhanced customers segmentation and product design initiatives converge to benefit consumers and their sources of debt financing, to the benefit of each.

[09] To understand the potential impact of national prepayment scoring standard, as manifested in the present invention, one need look no farther than the existing default risk scoring standard, owned and distributed by Fair, Isaac and Company, Inc. (Fair Isaac) for over 30 years. By establishing a standard methodology for scoring borrower default risk, and broadly disseminating it, Fair Isaac dramatically enhanced mortgage lender insight into expected loan dynamics. In finance, enhanced insight is synonymous with enhanced information. Enhanced information implies reduced risk for the lender. Finally, reduced lender risk profiles produce lower costs of capital. In other words, because Fair Isaac standardized successfully a fungible measurement of default risk, more money is available for consumers to borrow, at better and cheaper interest rates. The market is more efficient than before and everyone benefits.

[10] To further qualifying the timeliness of the invention, please refer to exhibit 1, "Green Tree chief returns \$23 million..." The Wall Street Journal, March, 1998. This story highlights the industry wide uncertainty surrounding prepayment speeds in consumer debt portfolios. One industry leading company, Green Tree Financial, "has been hit hard the past year by escalating loan losses in the painful recognition that its accounting has been too aggressive. Also, an unexpected wave of loan prepayments hit the industry, as borrowers sought lower interest rates, indicating working-class consumers were not as unsophisticated as lenders had believed." Stated plainly, Green Tree overstated prior year earnings significantly, exercising its option under GAAP accounting to roll forward and capture in advance projected lending profits, even though those very profits were merely estimated based in part on arbitrary prepayment assumptions. In large measure because Green Tree badly miscalculated these prepayments speed assumptions, in 1997 the company was forced to charge off \$390 million of 1996 reported profit. In 1998 the company was sold off to Conseco.

[11] Earlier disclosures in the area of prepayment scoring in a lending context are limited or nonexistent. United States Patent No. 5,696,907, entitled "System and Method for Performing Risk and Credit Analysis of Financial Service Applications," issued to Tom. The Tom patent discloses using a neural network to mimic a loan officer's underwriting decision making. The method of the Tom patent is based on a non-iterative regression process that produces an approval criterion that is useful in preparing new or modified underwriting guidelines to increase profitability and minimize losses for a future portfolio of loans. A prepayment observation is used in the neural net as a negative flag, but no prepayment scoring system is utilized in the

Tom patent.

- [12] In view of the prior art, there is a clear need for measuring and predicting a consumer's prepayment propensity, as well as a clear and strong need for a method and apparatus to produce such a measuring and predictive parameter.

BRIEF SUMMARY OF THE INVENTION

- [13] The system and method of the present invention generally works in the following manner: the service bureau or broker will electronically capture individual loan applications from consumers. Those loan applications will be sent to lenders for evaluation. The lender, using the present invention submits the loan application for review and analysis. The loan application will be reviewed by the present invention according to a sophisticated economic and customer behavior model, which will score the prepayment behavior of candidate borrowers. The score for these borrowers, which is an index of their prepayment propensity, will be electronically returned to the lender. The lender will in turn use the prepayment score and calibrate an appropriate mortgage price including the setting of interest rates, fees, broker commissions, and potentially consumer rewards. Using this consumer scoring technique, a lending institution can seek to contact or contract with those consumers who display a low propensity to prepay.

- [14] The advanced scoring of customer prepayment propensities materially improves the lender's to risk profile as regards new lending customers. This novel insight adds value to the marketing, underwriting, lending, administrative process for first and second mortgages, credit card balance transfers, and asset-backed term loans such as

automobile loans. By assisting lenders in their efforts to segment customers according to this crucial behavior metric, waste and excess costs are driven from the lending economy. More money is thus available, more cheaply, for more people.

[15] To the borrower, this system offers several advantages. First, more favorable loan terms can be made to those consumers who exhibit a beneficial borrowing behavior, i.e., borrowers who are not likely to prepay their loans but instead maintain their loans for a profitable duration. Further, dealing with a stable borrower market results in a more favorable financial environment on for all lenders thereby mitigating the risk of loss and, in the normal course of all efficient markets, passing that financial advantage onto borrowers generally.

[16] Once again, the irrefutable economic relationship between financial risk-taking and expected financial reward informs the environment addressed by the present invention. If lenders reduce their risks-and by extension their costs-through enhanced prepayment scoring, ultimate borrowing costs paid by consumers will decline.

[17] For the loan originator, the system offers several advantages. The loan originator can more efficiently price the particular loan. Further the loan originator can more efficiently select brokers and intermediaries who will select the best borrowers. Further, the system and method of the present invention will lead to more efficient direct and indirect marketing investments by identifying individual consumers and groups of consumers who exhibit the most beneficial borrowing behavior, i.e., a propensity not to prepay financial obligations.

[18] Given that direct marketing costs are exploding as the conventional direct channels (e.g. mail and outbound telemarketing) become saturated, any available efficiency in the direct marketing process is highly desirable. For example, in the marketing of home equity lines of credit (i.e. second mortgages), direct-mail response rates are now, on average, running below 0.3% (i.e. below 3/10ths of one percent). Obviously, some fraction of even this small respondent sample will prove ill-suited, as regards prepayment behavior, for the debt product being marketed. Therefore, the tailoring of specific debt products to consumers of specific prepayment behavior characteristics is essential to the efficient pricing of debt instruments. Lead generation, third-party data acquisition, underwriting, yield spread calculations all directly inform debt instrument profitability, and are all beneficially affected by the present invention.

[19] Finally, in the context of sophisticated asset liability management (ALM), subtle prepayment behavior analysis provides significant benefits to its practitioners. Because ALM, as a primary objective, seeks to minimize destructive asymmetries in asset and liability cash flows, intelligent risk managers will utilize debt contracts of varying expected durations to strengthen their balance sheet. For example, a lender's risk manager may seek multiple classes of debt instrument, reflecting multiple prepayment profiles, in order to assure himself of adequate incoming cash flow to sustain his expected liability cash outflows. In the matching, therefore, of expected cash in- and out-flows, the prudent risk manager utilizes a carefully segmented portfolio of debt instruments scored by prepayment propensities (and other measures) and priced accordingly, to avert liquidity crises.

[20] An additional, equally valuable use of the present invention is in the valuation of existing mortgage or debt instrument blocks of business. This valuation may be required by lender risk managers, auditors, regulators, or investors; it may reflect stakeholder interest in actively managing asset-liability risk, or it may be performed as part of the merger and acquisition appraisal. In all instances, the prepayment scoring system quantifies from a granular perspective upward to a pool, or block perspective, the prepayment speed characteristics of the debt instruments. As we have seen in the Green Tree case, failing to adequately price prepayment risk has enormous balance sheet implications, and typically leads one to grossly over value a portfolio or the enterprise itself.

[21] For auditors, the system of the present invention offers a quantitative measure of prepayment risk thus reducing auditor exposure to "claw-back" write-downs. This situation occurs in the case of issuers that secure these mortgages and, under the generally applied accounting procedures (GAAP) accelerate and capture earnings based on certain prepayment assumptions. If those prepayment assumptions are incorrect, prior year financial statements are incorrect and massive charges are required to reflect lower portfolio earnings.

[22] For banking regulators, the system of the present invention offers the ability to quantify balance sheet risk resulting from expected consumer prepayment behavior. This will allow regulators to more precisely measure and assign minimum bank capital levels.

[23] For credit rating agencies, the ability to score according to an objective, standard

methodology prepayment risk provides enormous assistance in rating a lender's creditworthiness. Rating agencies function, effectively, as credit market bellweathers. Lending institutions are dependent on favorable credit ratings in order to float their institutional debt at advantageous rates; rating agencies, as in the case of regulators, evaluate carefully lenders' claims of capital adequacy; the capital (cash reserves) retained by lenders is directly and immediately affected by debt instrument prepayment speeds. This is because, under GAAP accounting rules, lenders are allowed to capture a substantial percentage of the future expected profits for a given contracted debt instrument, and those profits are themselves substantially dependent on the assumed life of the instrument. (In the case of subprime mortgages, for example, profits may double if the mortgage is maintained in force for four years instead of three). If those profits are overstated, they must be reversed, with resultant charges reducing lender capital (capital: paid-in cash investments plus retained profits). Therefore, rating agencies must scrutinize lender portfolio prepayment speed assumptions, because if those assumptions prove false, then the lender will suffer a reduction in capital. Any significant impairment of lender capital necessarily suggests a reduction in its credit rating. Credit rating agencies will be major beneficiaries and users of the present invention.

- [24] For investment bankers, the system of present invention establishes a standardized prepayment methodology that allows merger and acquisition advisers to be able to quantitatively measure the balance sheet risk in a target banking or mortgage company. In addition, investment bank usage of the present invention will include its application to debt instrument securitization. Securitization describes the process

by which pools of mortgage or other debt instruments are purchased by investment banks-in their capacity as underwriters-and re-sold to institutional and public investors as reconstituted securities. Typically, these securitizations benefit originators of debt, because they realize significant acceleration in realized profits; they also significantly diversify their risks by selling significant aspects of the debt instrument to asset underwriters and others. However, the typical debt instrument securitization proceeds with the originating lender retaining significant prepayment risk; if prepayment speeds accelerate beyond levels assumed in the securitization pricing process, the originating lender is held responsible. Hence the invention, by measuring the expected prepayment behavior and scoring in according to an accepted, industry standard method, will improve the securitization process and render it more efficient. Once again, this will reduce costs for all participants and free up more capital for lower-cost consumer borrowing.

[25] For investors, the method of the present invention provides a way to make investment decisions based upon quantified debt instrument prepayment behavior risk for lending institutions in which investors might want to invest, or to evaluate the relative stability of mortgage securities that are backed by individual debt instruments.

[26] These and other advantages of the present invention are described in reference to the specification that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[27] **Figure 1** is an overview of the process of the present invention.

- [28] **Figure 2** is a block diagram of the present invention.
- [29] **Figure 3** is a block diagram showing the user interface module connections.
- [30] **Figure 4** is block diagram showing the interactions with the prepayment historical data.
- [31] **Figure 5** is a block diagram showing the interactions with the econometric model.
- [32] **Figure 6** is a block diagram showing the factors that are used by the user interface module.

DETAILED DESCRIPTION OF THE INVENTION

- [33] Referring to **Figure 1**, an overview of the process of the present invention is shown. The mortgage broker or lending institution first obtains a loan application from a borrower **10**. That information is electronically transmitted to the present invention, which parses the information **12** of the loan application into various categories that are relevant to the scoring of the potential loan. The loan application contents are parsed based upon the information needs of a sophisticated, mathematical model resident in the present invention. A prepayment score is then derived **14** for the particular consumer as a function of the particular loan type being requested, and in further view of the interest rate environment in which the loan is being processed (i.e. rising or falling interest rates). As previously noted this score is an indication of the prepayment propensity of a particular consumer. The prepayment score is then returned to the lender **16**. Thereafter the lender can create a customized loan product that rewards favorable prepayment behavior of the

consumer 18.

[34] Referring to **Figure 2**, an overview of the system of the present invention is shown. A loan originator **20** receives the application from a potential consumer. That application is then input to the loan originator's data delivery channels **22**. Such data delivery channels **22** are (without limitation) e-mail, fax, Internet, and generally other electronic means. Other loan originators **34** also send their respective consumer applications over their own data delivery channels **36**.

[35] The present invention anticipates delivery of loan applications **24** over the Internet **28** or other digital electronic means such as wireless communications methods as well. Electronic loan applications **40** enter the system of the present invention through a communication server **42**. The loan information concerning a given consumer is then submitted to an application parser **52**. Application parser **52** divides the information into loan information **58** and applicant information **56**. Loan information **58** is information that relates to the amount, the term, down payment, loan type, and other information important and relating to the amount of money to be loaned. Applicant information **56** is information such as name, address, Social Security number, and other demographic information concerning the applicant.

[36] Loan information **56** is fed into a prepayment model library database **66**. The prepayment model library database **66** comprises information concerning prepayment historical data **62**. The results are fed into model training server **64** which processes prepayment historical data **62** of both an individual and demographic groups which in turn provides updates to the model library database **66**.

Once loan information 58 is processed by the prepayment model library database 66 an analytical prepayment model 60, which is based upon the loan information 58 is provided to the prepayment calculation server 46. Prepayment calculation server 46 receives additional information from econometric model 48 which establishes the relationship among the wide variety of variables. Econometric model 48 generates interest rate, mortgage rate and other economic parameters that, arrayed in time series, comprise scenarios utilized by the prepayment calculations server. These scenarios are generated from the Low Discrepancy Sequence (LDS) logic, rather than using random number generation. The LDS logic affords significantly higher model accuracy with the same number of scenarios.

[37] Once a prepayment score 44 is derived by prepayment calculation server 46, prepayment score 44 is sent to the communication server 42 and is transmitted over the Internet (or other electronic channels) 28 through the data delivery channels 22 or 36 back to loan originators 20 or 34 who can then either approve, disapprove, or create customized loan product for the consumer.

[38] Prepayment score 38 is calculated based upon the following model. The specific prepayment analysis of the present invention is conceptually shown below.

[39] The following variables:

[40] $A = (a_1, a_2, \dots, a_n)$

[41] $L = (l_1, l_2, \dots, l_m)$

[42] are vectors of the applicant's data and loan parameters.

[43] $E_s(t) = (e_{1s}(t), e_{2s}(t), \dots, e_{k_s}(t)); \quad s = 1, \dots, S$

[44] denotes a set of Low Discrepancy Sequence (LDS)-based scenarios of the econometric parameters, which have been generated by the RTH Linked Index Econometric Model. Thus the model is a set of stochastic differential equations that describe the dynamics and interaction of major macroeconomic indicators, each relevant to the prepayment propensity calculation.

[45] Analytical Prepayment Model \mathfrak{R} , which varies with the types of loan applied for, is trained to calculate prepayment value p_s in a given scenario based on the applicant's data (A), loan parameters (L), and econometric parameters (E):

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

[46] Total prepayment, accumulated by the time T in scenario s , can be calculated as:

$$P_s(T) = \prod_i p_s(t_i)$$

[47] Then, total prepayment at time T is given by:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

[48] Finally, the prepayment score is:

$$Score = \sum_T TP(T)$$

[49] The analytical model that produces the prepayment score may be further informed

by additional external behavioral or econometric factors, based on subsequent research, as well as the aforementioned behavioral scoring of mortgage broker behavior.

[50] The present invention may also be represented in an alternative embodiment in the form of the credit engineering workstation (CEW). This CEW (more fully described below) comprises a user interface which allows a loan originator to conduct all of the prepayment calculations, model analysis, and pricing of the present invention using the prepayment model first noted above.

[51] The CEW operates in either a Unix or Windows NT environment using Oracle, SQL server, Sybase, DB2, or Informix database support. The CEW also uses CORBA or, structured object models together with a JAVA/HTML browser based graphical user interface.

[52] The subroutines of the CEW all contribute to the end goal of determining the prepayment propensity of a consumer. For example, subroutines of the present invention deal supports the generation of various interest rate scenarios, and subsequent economic scenarios model fitting processes that fit the modeled interest rates scenarios to historical and current interest rate yield curve performance as well as to other macro economic indicators.

[53] Part of the system includes rewards pricing logic to efficiently measure and price the impact of rewards on consumer prepayment behavior. For example it would be most beneficial to a lender to reward the consumer for not prepaying the lender's loan. Such a reward could be assessed in terms of its impact on the consumer

prepayment behavior. The system therefore permits the end-user to design pro forma rewards structures and to test their impact on prospective consumer prepayment behavior.

[54] Various user definable screens also establish default spreads, prepayment spreads, broker commission schedules, and other financial factors that influence the pricing of the product to be offered to the consumer. Various other economic scenarios are collected via the user interface and combined with various probabilities and default data as well as other lender defined criteria result in rationally priced end-user mortgage contracts.

[55] Referring to **Figure 3**, further information concerning the CEW of the present invention shown. The system comprises user interface module **70** which is the basic graphical user interface and other software that allows an originator to provide information concerning a consumer who wishes to borrow money from lender. The user interface module allows the collection of loan attributes **76**, applicant attributes **74**, and reward program attributes **72**. In addition user interface module **70** collects or calculates spreads, broker commissions and other costs associated with the loan **78**. Loan attributes **76** and other loan related costs are fed into pricing engine **84** which, with other information, assists in creating an appropriate loan price **86**.

[56] Loan attributes **76**, applicant attributes **74**, and reward program attributes **72** all which have an impact on the value of the loan are fed into prepayment calculation server **80**. Prepayment calculation server **80** receives input from the various prepayment model parameters and creates prepayment score **82**.

[57] Referring to **Figure 4**, a block diagram showing the interactions which are necessary to create a prepayment model are shown. Consumer information **96** which consists of applicant attributes **74** and loan attributes **76** are fed into a prepayment model fitting **92** module. Prepayment model fitting **92** establishes various prepayment model parameters **94** based upon prepayment historical data **90**. Once the appropriate prepayment model is created by prepayment model fitting **92**, a model is returned to the prepayment calculation server for the calculation of the prepayment score of the particular consumer given the type of loan to consumer is requesting. The prepayment calculation server also benefits from input from an econometric model scenario generator.

[58] Referring to **Figure 5**, the interactions for the econometric model are shown. Econometric model scenario generator **106** receives input from econometric model fitting module **104** and LDS scenarios **108**. Econometric model fitting module **104** receives information from econometric historical data **100** and current market environment **102** which comprises, without limitation, information concerning rising or falling interest rates and trends. The information from econometric historical data **100** concerns the demographic group to which the consumer belongs and other econometric information such as age, income, credit rating, occupation and other factors. The information from current market environment **102** concerns the direction and velocity of changes to interest rates. Econometric model scenario generator **106** processes the information and produces various scenarios based on the information.

[59] Referring again to **Figure 3**, prepayment calculation server **80** creates prepayment score **44** for the particular consumer in question. Prepayment score **44** is based upon

the established prepayment model and the generated econometric model.

Prepayment score **44** is transmitted to the pricing engine **82** to establish the pricing of the loan product to be offered to the consumer in question.

[60] Referring to **Figure 6**, additional parameters which the user interface module uses to create the various scenarios are shown. Additional aspects of the present invention provide for creation of new products. Strategy optimizer **122** is based upon acceptance of offered products by consumers and input from and relating to other products are on the market. Strategy optimizer **122** generates marketing plans based upon individual lenders' portfolios. Such a market plan could assist the lender in offering new products to the marketplace that are more profitable for the lender. The system includes targeting optimizer **124** which provides a way to offer loan products to those consumers having the most favorable prepayment characteristics, i.e., a low propensity to prepay loans made. The system also comprises loyalty optimizer **126** which models and defines offers and other inducements to consumers to reward financially advantageous consumer behavior. Channel optimizer **128** is part of the present invention. Channel optimizer **128** analyzes the channels of delivery of financial product offerings to evaluate and determine the channel that is the most efficient way to deliver various financial products. The system also comprises database optimizer **130** which receives and organizes information in the various databases to constantly build and refined prepayment historical data **90** and econometric historical data **100**.

[61] The target platform on which the system of the present invention will run is either an Intel Pentium processor based system with typically 32 megabytes of RAM, hard

disk storage and retrieval, and communications capability using the TCP/IP protocol. Alternatively the system will also run under the UNIX operating system on a Sun Solaris platform. In both cases displays for users are anticipated as is the ability to output hard copy reports. In typical operation, a plurality of users, remote from the system site will access the system via private networks or over the Internet to send the information necessary for the present invention to make the desired calculations leading to the prepayment score. This score is then sent back to the requesting user at the remote terminal.

[62] Although described herein with respect to a mortgage loan or loan, the present invention is applicable to numerous financial instruments that have a value that depends on the particular consumer's actions over time. The value of typical debt instruments, such as, but not limited to, mortgages, second mortgages, home equity loans, car loans, school loans, term loans, leases, credit card accounts, and credit card balance transfers, depend on a continued stream of cash and are therefore affected significantly by prepayment.

[63] The value of other instruments that depend on the cash stream over time, such as open-end car leases and whole-life insurance policies, can also depend on the consumer's actions, and therefore, for purposes of this invention can be considered as a form of debt instrument. In the car lease scenario, predicting the probability of a consumer electing to purchase or return the car before the end of the lease (prepay) is important in determining the value of the lease. Even a consumer's predisposition to keeping (purchasing at residual value price, a type of prepayment) or returning the car at the end of the lease can be used to modify the lease terms to the leasing entity's

advantage.

- [64] Likewise, the likelihood of a consumer to cash out the surrender value of a whole-life insurance policy (another form of prepayment, albeit in the opposite direction, that ends the stream of cash) can significantly affect the ultimate value of the policy to the insurer.
- [65] Known database and computer-based data mining techniques can be used for analyzing: the value of financial instruments (and portfolios in which they are packaged) based on the prepayment score associated with each of them; the risk associated with portfolios containing the financial instruments; and the pricing for servicing those portfolios. Additionally, instruments can be packaged together into portfolios based, at least in part, on the prepayment scores of the applicants.
- [66] A system and method for prepayment score generation has been described. Those skilled in the art will appreciate that other variations of the present invention are possible without departing from the scope of the invention as described.

WHAT IS CLAIMED IS:

- [c1] A system for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:
- at least one debt instrument origination computer terminal for accepting and transmitting a debt instrument application of an individual applicant;
 - a computer network connected to the at least one debt instrument origination computer terminal for receiving the transmitted debt instrument application of the individual applicant;
 - a communication server connected to the computer network for receiving the transmitted debt instrument application of the individual applicant;
 - an application parser connected to the communications server for receiving the transmitted debt instrument application of the individual applicant from the communications server and parsing the information into debt instrument information and applicant information;
 - a prepayment model library database comprising debt instrument prepayment models connected to the application parser for receiving the debt instrument information and fitting the debt instrument information into the debt instrument prepayment models and for transmitting debt instrument prepayment models that match the debt instrument information; and
 - a prepayment calculation server comprising a prepayment score generation model connected to the prepayment model library database for receiving the debt instrument

prepayment models and calculating a prepayment score for the debt instrument application of the individual applicant based upon the debt instrument prepayment model and the prepayment score generation model, the prepayment calculation server being further adapted to transmit the prepayment score to at least one debt instrument origination computer terminal via the communications server and the computer network;

where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment; and

wherein the at least one debt instrument origination computer terminal is adapted to use the prepayment score to adjust terms of the debt instrument of the individual applicant.

[c2] The system for determining a prepayment score of claim [c1], where the prepayment model library database further comprises:

a model training server for creating the debt instrument prepayment models for the prepayment model library database; and

prepayment historical data storage means connected to the model training server, the prepayment historical data further comprises prepayment statistics regarding debt instruments of various types.

[c3] The system for determining a prepayment score of claim [c1], where the prepayment calculation server further comprises an econometric model that

generates Low Discrepancy Sequence (LDS)-based scenarios of econometric parameters for input to the prepayment calculation server.

- [c4] The system for determining a prepayment score of claim [c1], further comprising means adapted to calculate a total prepayment at time T from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

- [c5] The system for determining a prepayment score of claim [c4], further comprising means adapted to calculate the total prepayment, accumulated by time, in scenario s from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

- [c6] The system for determining a prepayment score of claim [c5], further comprising means adapted to calculate the prepayment value in a given scenario from the formula:

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \mathfrak{R} is an analytical prepayment model.

- [c7] The system for determining a prepayment score of claim [c1], where the applicant is either an individual consumer or an individual household.
- [c8] The system for determining a prepayment score of claim [c1], further comprising computer-based means for using data associated with the prepayment score of the applicant and terms of the debt instrument to determine a calculation selected from the group consisting of: a value of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.
- [c9] A method for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:
- collecting debt instrument and applicant information at a debt instrument originator;
 - transmitting the debt instrument and applicant information over a network;
 - receiving the debt instrument and applicant information at a service bureau;
 - the service bureau calculating a prepayment score the individual applicant, where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment;

the service bureau returning the prepayment score over the network to the debt

instrument originator; and

the debt instrument originator using the prepayment score to customize a debt instrument product for the individual applicant.

[c10] The method for determining a prepayment score of claim [c9], where calculating a prepayment score for the applicant comprises parsing the information into debt instrument information and applicant information.

[c11] The method for determining a prepayment score of claim [c10], further comprising providing the applicant information to a prepayment model library database and the debt instrument information to a prepayment calculation server.

[c12] The method for determining a prepayment score of claim [c11], further comprising the prepayment model library determining the prepayment model that best applies to the debt instrument information and providing that prepayment model to the prepayment calculation server.

[c13] The method for determining a prepayment score of claim [c12], further comprising the prepayment calculation server receiving a prepayment model and an econometric model, where the prepayment calculation server further calculates a prepayment score for the applicant.

[c14] The method for determining a prepayment score of claim [c13], where the total prepayment at time T is calculated from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

[c15] The method for determining a prepayment score of claim [c14], where the total prepayment, accumulated by time, in scenario s is calculated from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

[c16] The method for determining a prepayment score of claim [c15], where the prepayment value in a given scenario is calculated from the formula:

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \mathfrak{R} is an analytical prepayment model.

[c17] The method for determining a prepayment score of claim [c9], where the applicant is defined as an individual consumer or an individual household.

[c18] The method for determining a prepayment score of claim [c9], further comprising rating a broker based on prepayment scores of applicants that are clients of said broker.

[c19] The method for determining a prepayment score of claim [c9], further comprising using the prepayment score of the applicant and terms of the debt instrument to assist in determining a calculation selected from the group consisting of: a value

of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c20] The method for determining a prepayment score of claim [c9], further comprising packaging said debt instrument into a portfolio based, at least in part, on the prepayment score of the applicant.

Abstract of the Disclosure

A method and apparatus is disclosed for determining the prepayment propensity of individual borrowers. Early payment of debt instruments, such as loans and leases, can lead to losses being suffered by lenders. The present invention analyzes the demographics associated with a particular borrower to determine both the individual and group based prepayment propensity. The history of the borrower, the history of the borrower's demographic group, interest rate trends and other factors are then used to calculate a prepayment score that can be used by the lender to determine the propensity of a given borrower to prepay the instrument in question. The score of the individual borrower can be used to estimate the profitability of a debt instrument and allow the lender to make appropriate adjustments prior to issuing the instrument. The individual prepayment scores of a lender's or broker's clients can also be used to rate the lender or broker.

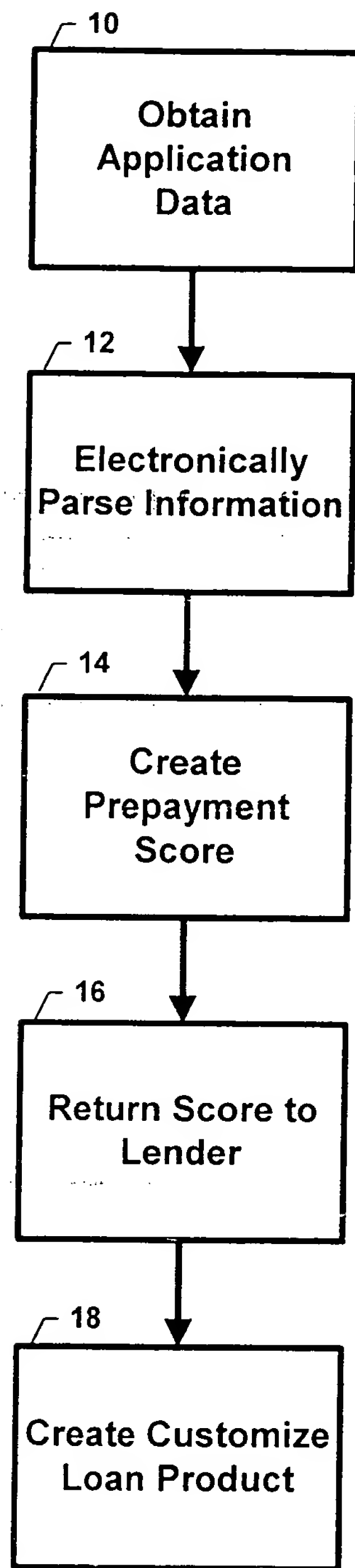


FIGURE 1

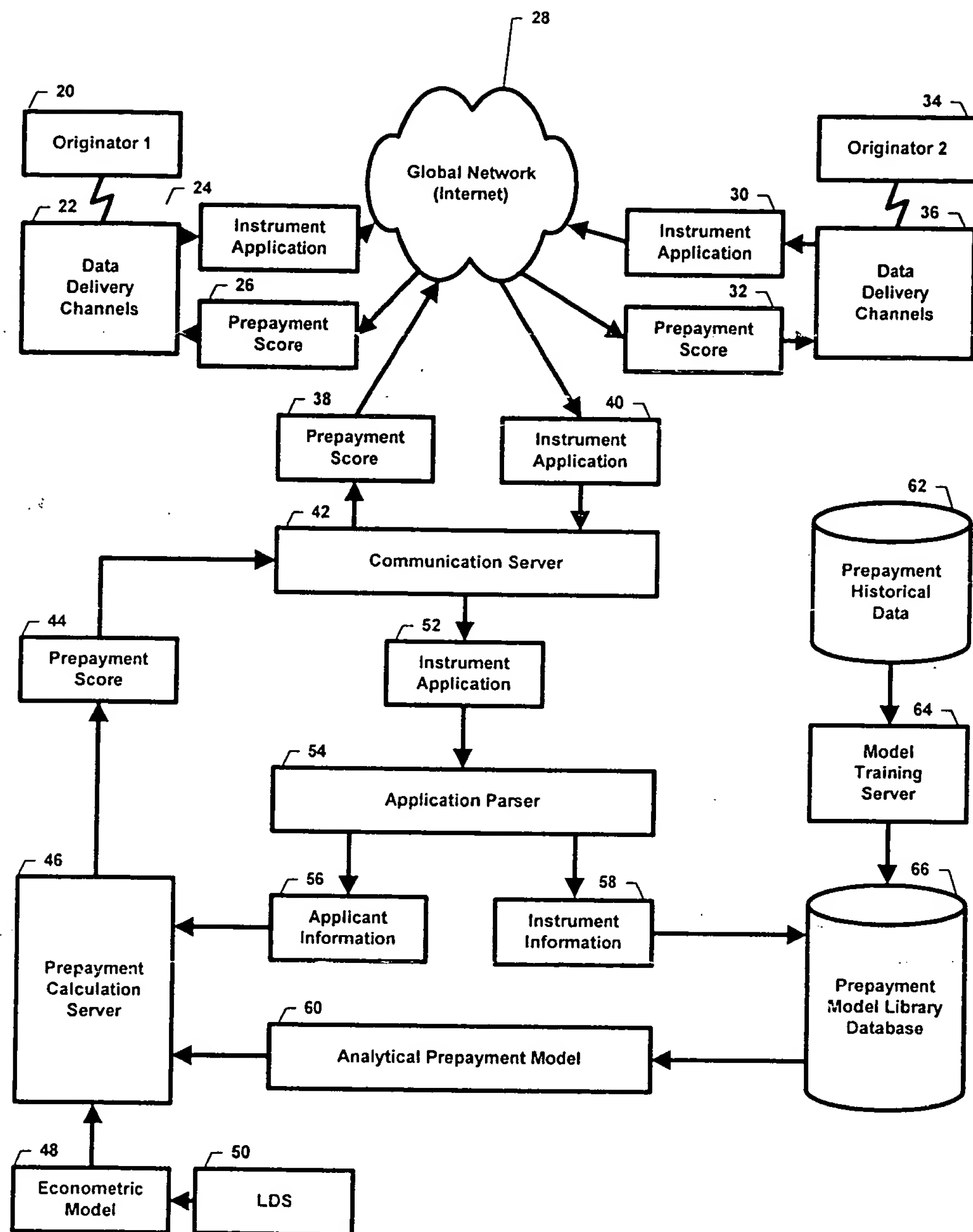


FIGURE 2

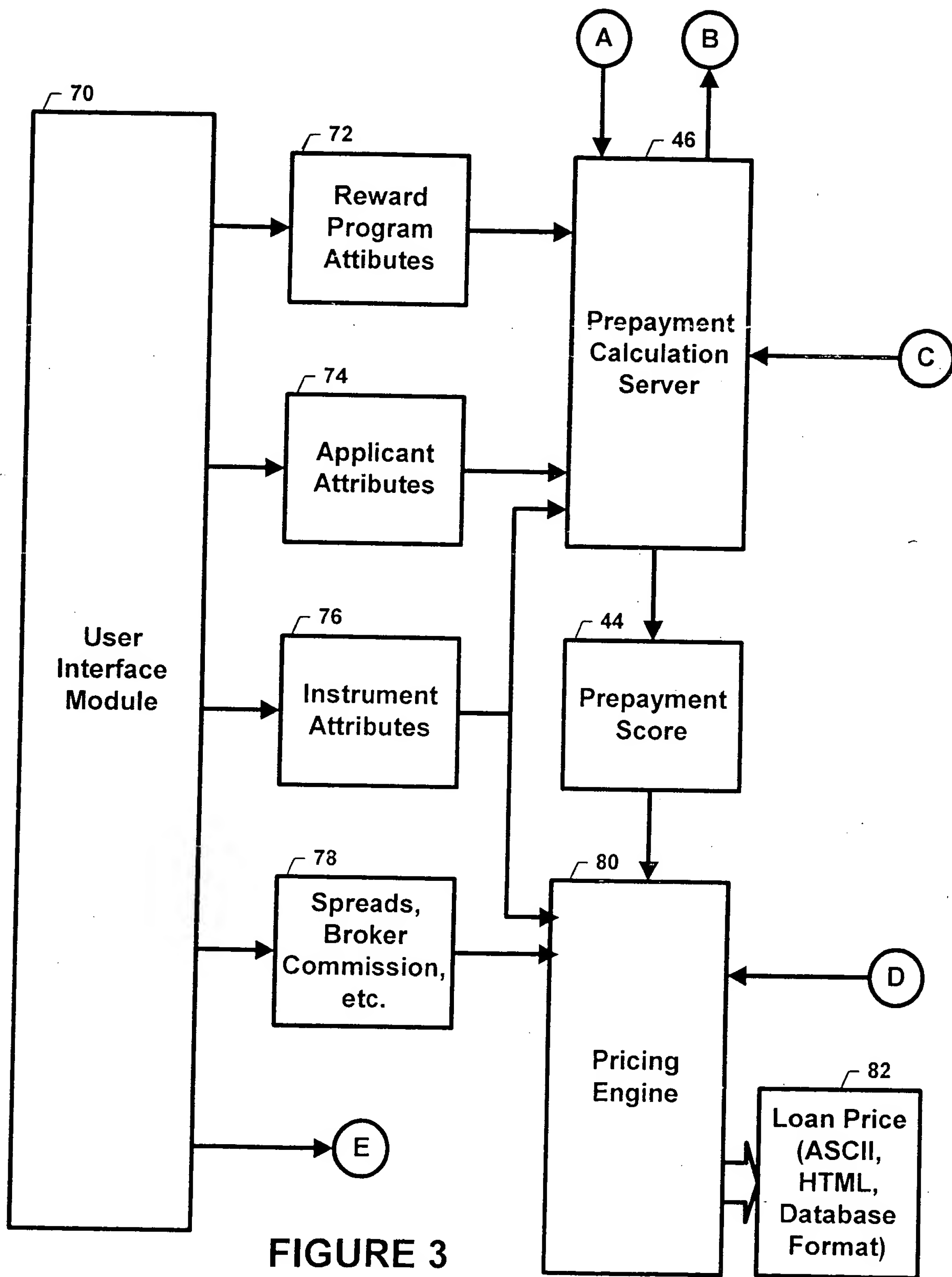


FIGURE 3

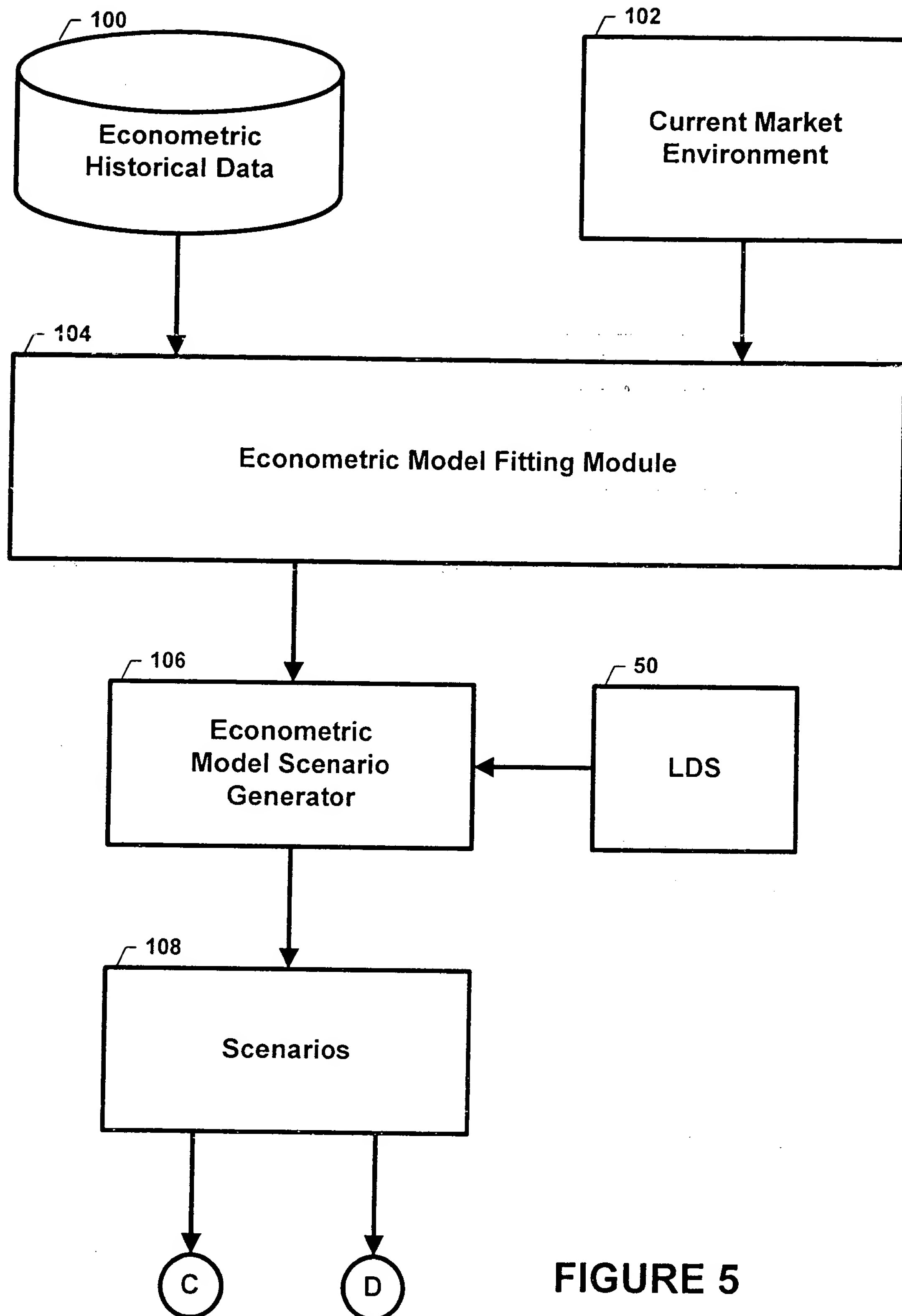


FIGURE 5

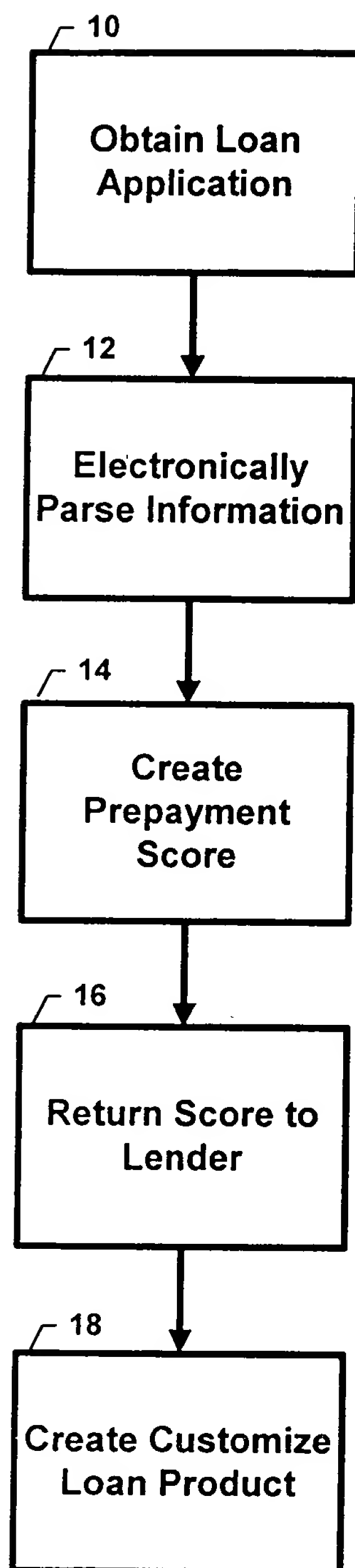


FIGURE 1

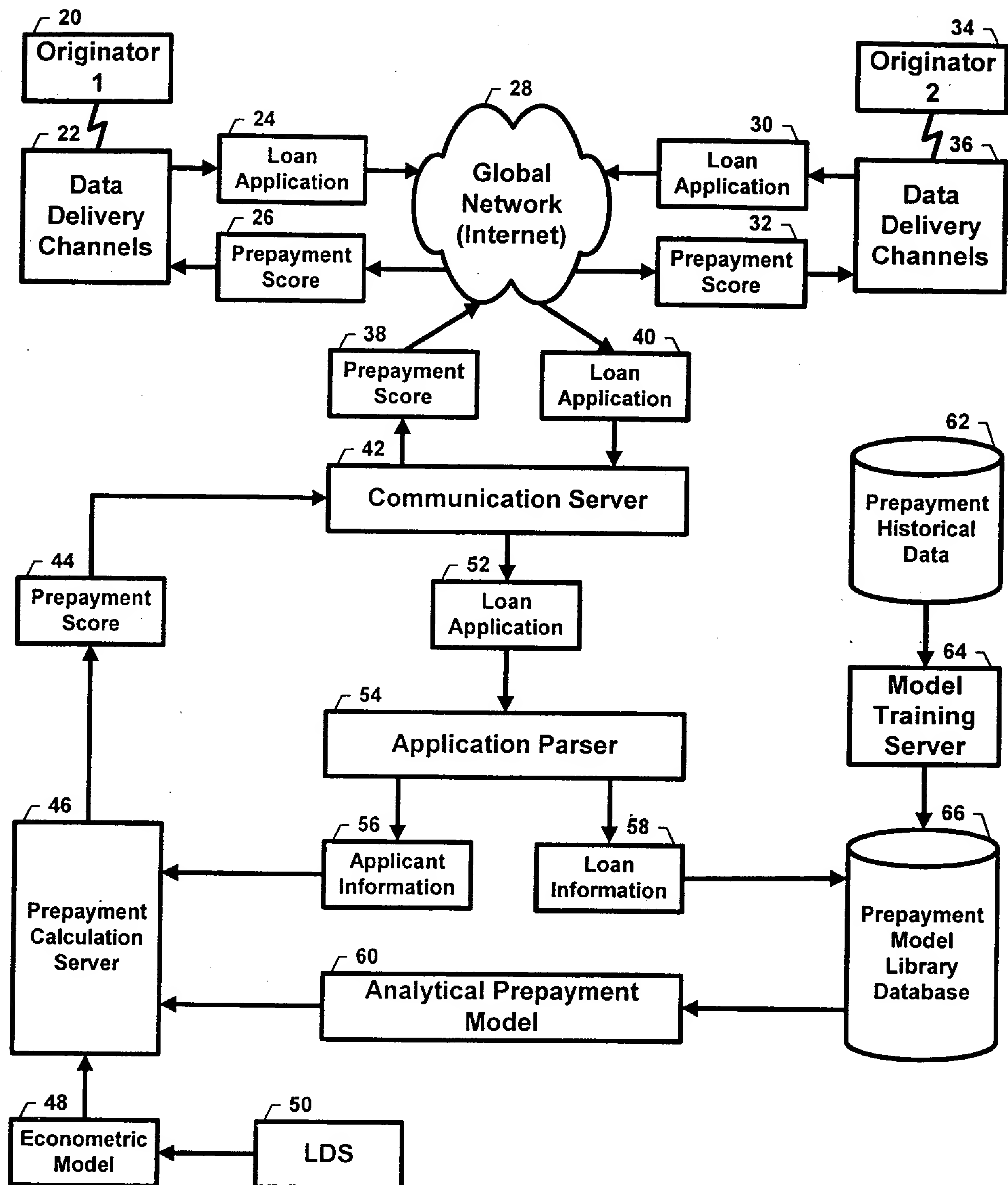


FIGURE 2

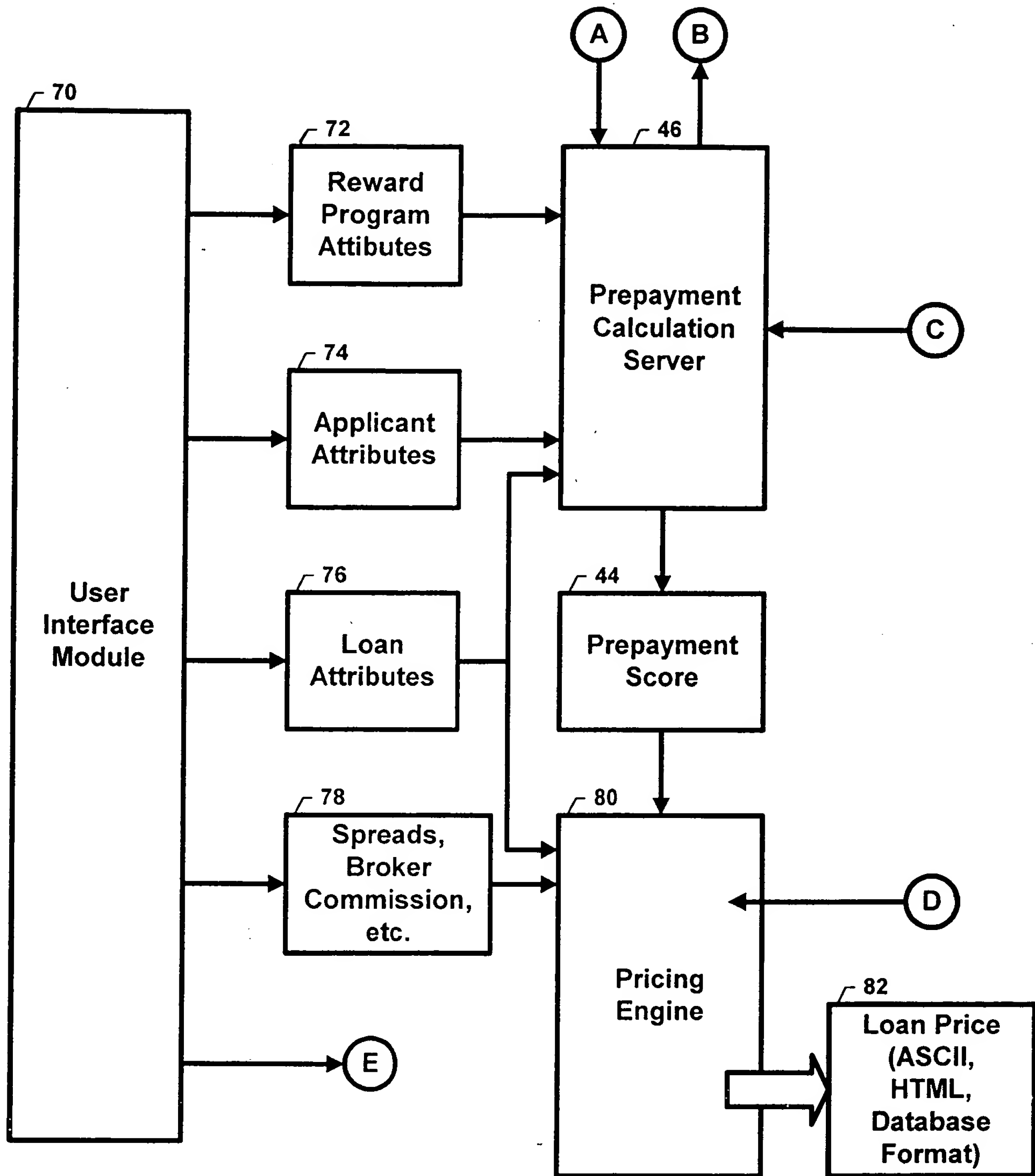


FIGURE 3

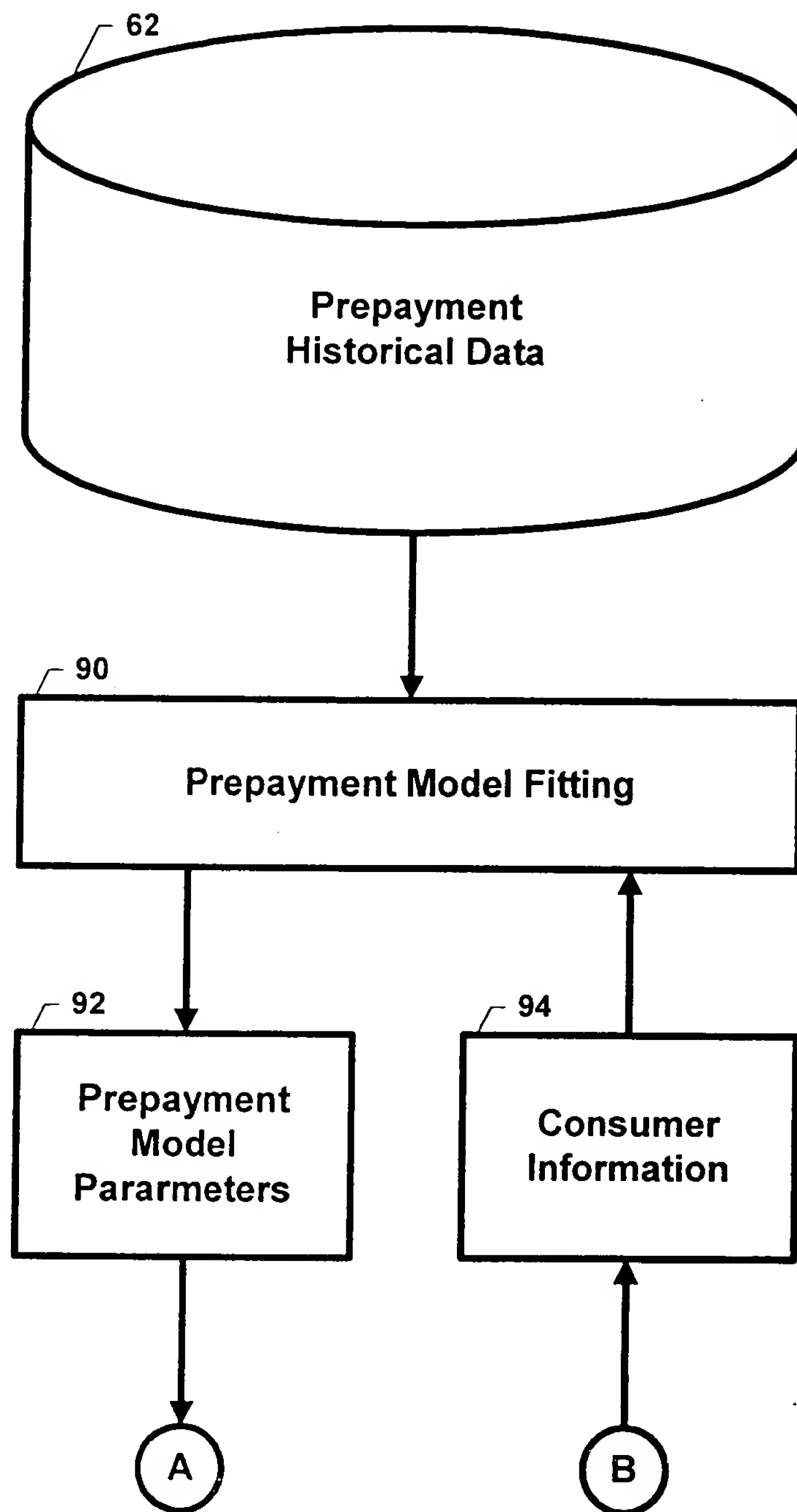


FIGURE 4

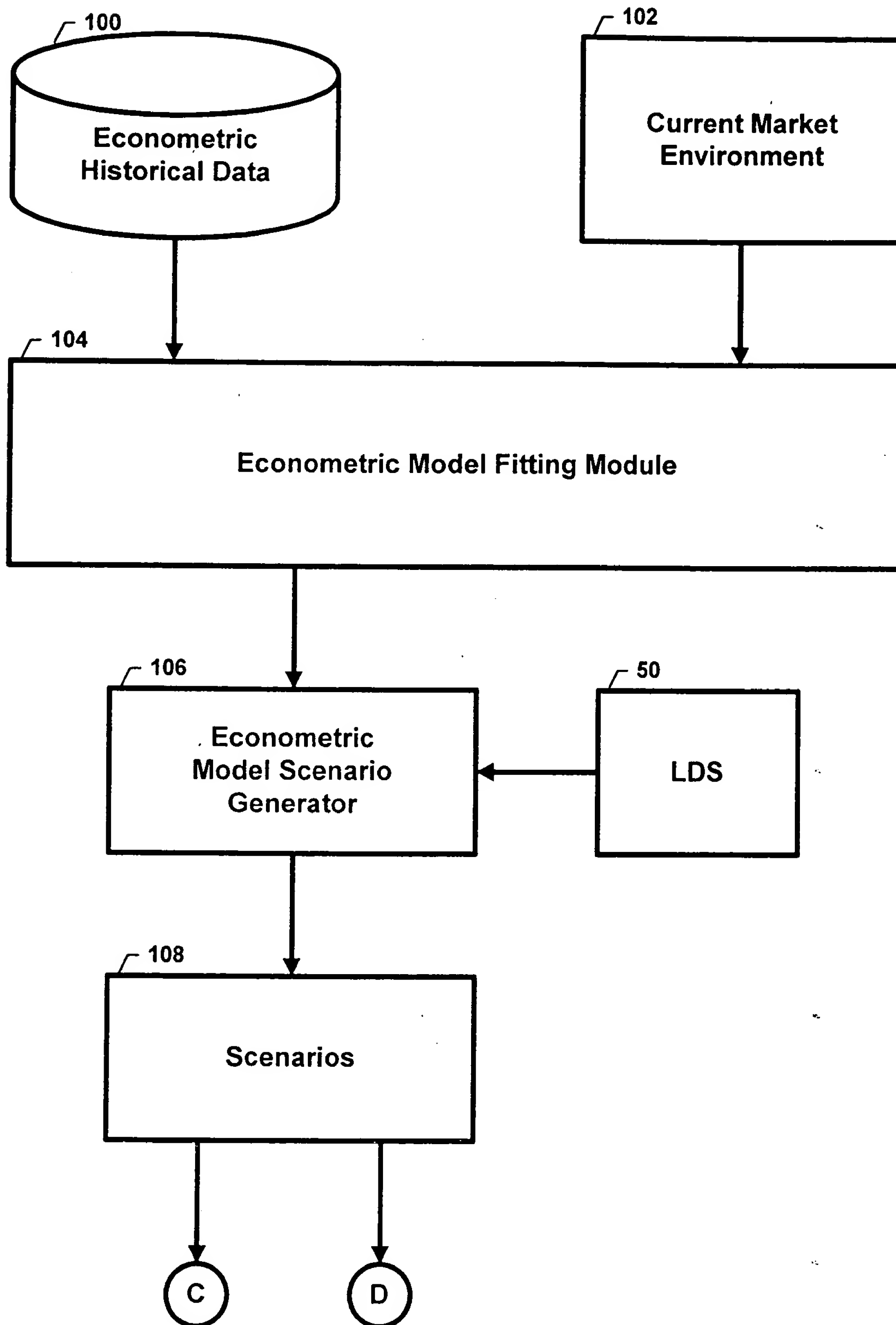


FIGURE 5

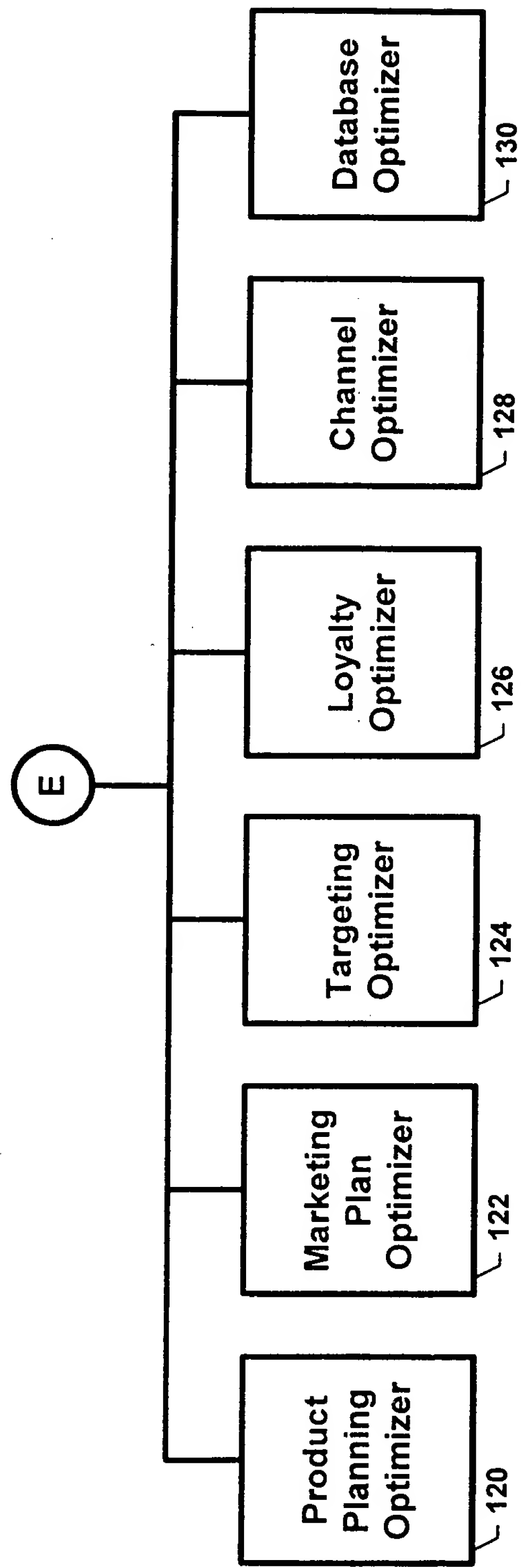


FIGURE 6

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Yuri Galperin, et al.
Appl. No.	:	09/942,983
PCT Filing Date	:	August 30, 2001
For	:	METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT
Examiner	:	Siegfried E. Chencinski
Group Art Unit	:	3692

STATEMENT OF CHARLES L. JONES III UNDER 37 C.F.R. § 1.48(a)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Charles L. Jones III, do declare as follows:

1. I am a citizen of the United States and reside at _____.
2. The above-referenced patent application was filed on August 30, 2001 listing Yuri Galperin, Vladimir Fishman and William A. Eginton as the joint inventors.
3. I believe that I, Charles L. Jones III, should also be named as an inventor in the above-referenced application.
4. The inventorship error occurred without deceptive intent on my part.

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or document, or any registration resulting therefrom.

Dated: _____

Charles L. Jones III

ASSIGNMENT

WHEREAS, I, Charles L. Jones III, residing at _____, am a joint inventor, along with Yuri Galperin, Vladimir Fishman, and William A. Eginton, of certain new and useful improvements in a METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT for which we have filed an application for Letters Patent in the United States, Application No. 09/942,983 Filed on August 30, 2001;

AND WHEREAS, MarketSwitch Corporation (hereinafter "ASSIGNEE"), a Delaware corporation, with its principal place of business at 2350 Corporate Park Drive, Suite 400, Herndon, VA 20171, desires to acquire the entire right, title, and interest in and to said improvements and said Application:

NOW, THEREFORE, in consideration of the sum of One Dollar (\$1.00) to me in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, I, said inventor, do hereby acknowledge that I have sold, assigned, transferred and set over, and by these presents do hereby sell, assign, transfer and set over, unto said ASSIGNEE, its successors, legal representatives and assigns, the entire right, title, and interest throughout the world in, to and under said improvements, and said application including all provisional applications relating thereto (including but not limited to U.S. Provisional Application No(s). 60/228,954, filed August 31, 2000 (respectively if plural applications)), and all divisions, renewals and continuations thereof, and all Letters Patent of the United States which may be granted thereon and all reissues and extensions thereof, and all rights of priority under International Conventions and applications for Letters Patent which may hereafter be filed for said improvements in any country or countries foreign to the United States, and all Letters Patent which may be granted for said improvements in any country or countries foreign to the United States and all extensions, renewals and reissues thereof; and I hereby authorize and request the Commissioner of Patents of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents on applications as aforesaid, to issue all Letters Patent for said improvements to said ASSIGNEE, its successors, legal representatives and assigns, in accordance with the terms of this instrument.

AND I DO HEREBY sell, assign, transfer, and convey to ASSIGNEE, its successors, legal representatives, and assigns all claims for damages and all remedies arising out of any violation of the rights assigned hereby that may have accrued prior to the date of assignment to ASSIGNEE, or may accrue hereafter, including, but not limited to, the right to sue for, collect, and retain damages for past infringements of said Letters Patent before or after issuance.

AND I HEREBY covenant and agree that I will communicate to said ASSIGNEE, its successors, legal representatives and assigns, any facts known to us respecting said improvements, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuing and reissue applications, make all rightful oaths and generally do everything possible to aid said ASSIGNEE, its successors, legal representatives and assigns, to obtain and enforce proper patent protection for said improvements in all countries.

IN TESTIMONY WHEREOF, I hereunto set my hand and seal this ____ day of _____, 20__.

Charles L. Jones III

STATE OF }
 } ss.
COUNTY OF }

On _____, before me, _____, notary public, personally appeared **Charles L. Jones III** personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged to me that he executed the same in his authorized capacity(ies), and that by his signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

[SEAL]

Notary Signature

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Second inventor: **Vladimir Fishman**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Third inventor: **William A. Eginton**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Fourth inventor: **Charles L. Jones III**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: _____

Mailing Address: same as above

Send Correspondence To:
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Customer No. 20,995

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- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
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1. Article Addressed to:

Charles L. Jones
4 Anchorage Lane
Marblehead, MA
01946

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☐ Agent
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B. Received by (Printed Name)

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D. Is delivery address different from item 1? ☐ Yes
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3. Service Type

☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee) ☐ Yes

2. Article Number

(Transfer from service label) 7006 0100 0004 5806 4458

PS Form 3811, February 2004

Domestic Return Receipt

102595-02-M-1540

From:

TMC

EXP. 046A

Knobbe Martens Olson & Bear LLP

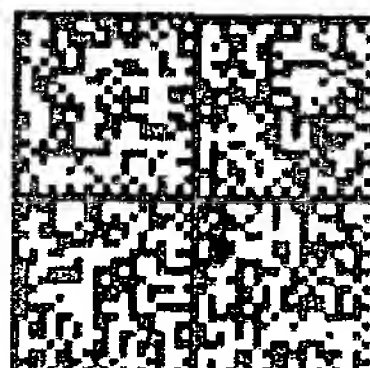
Intellectual Property Law

2040 Main Street, 14th Floor, Irvine, CA 92614

To:

Mr. Charles L. Jones
4 Anchorage Lane
Marblehead, MA 01945

(F)



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Mailed From 92614
US POSTAGE

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RETURN RECEIPT
REQUEST

JONE004* 019453008 1B06 03 12/22/07
FORWARD TIME EXP RTN TO SEND
JONES, CHARLES L III
4570 OLD POST RD
CHARLESTOWN RI 02813-2560
RETURN TO SENDER

7006 0100 0004 5806 4458

January 14, 2008

VIA CERTIFIED MAIL
No. 7006 0100 0004 5806 4533

Charles L. Jones
4570 Old Post Road
Charlestown, RI 02813-2560

Re: Patent Application for Prepayment Score
Application No. 09/942983
Our Reference: EXP.046A

Dear Mr. Jones:

As you know, a patent application for your invention entitled METHOD AND APPARATUS FOR DETERMINING LOAN PREPAYMENT SCORE was filed on May 15, 1998 and assigned Application No. 09/078,867, which is now issued Patent No. 6,185,543. You, Yuri Galperin, Vladimir Fishman and William A. Eginton were listed as inventors on this application. A later related application was filed on August 30, 2001 and assigned Serial No. 09/942,983, but did not include you as an inventor. It is our understanding that you were erroneously left off this application through no deceptive intent on your part.

Therefore, we are filing a Petition with the U.S. Patent Office to correct inventorship on the related application. In order to correct inventorship we need you to sign a declaration acknowledging that you and the other three inventors are the inventors of this application. In addition, you need to sign a Statement indicating that you were erroneously left off this application through no deceptive intent on your part ("Statement").

I have enclosed a copy of the application as filed (including the specification, drawings and claims), the Statement and an Assignment of the invention to Marketswitch. Please review the application to confirm that you should be added as an inventor.

Charles L. Jones
January 14, 2008
Page -2-

After your review, please sign and promptly return to me the Declaration, the Statement, and the Assignment in the pre-addressed envelope.

If you have any questions or if you would like to discuss this matter, please do not hesitate to contact me.

Sincerely

A handwritten signature in black ink that reads "Ted M. Cannon". The signature is fluid and cursive, with a long horizontal stroke at the end.

Ted M. Cannon

Enclosures
4652533:kc/121307

SPECIFICATION

TITLE: METHOD AND APPARATUS FOR DETERMINING A
PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT

RELATED APPLICATIONS

[01] This application claims the benefit of Provisional Application Serial No. 60/228,954, filed August 31, 2000, which is incorporated herein in its entirety.

FIELD OF THE INVENTION

[02] This invention relates generally to receiving applications for and processing of lending transactions. More specifically this invention provides a method and apparatus to assess the prepayment propensity of a borrower in the form of a prepayment "score" to enable assessment of (i) the value of mortgages, second mortgages, home equity loans or other debt instruments for investors, (ii) the value of credit card accounts and balance transfers, (iii) the value of term loans and leases, (iv) the behavior of brokers with respect to churning, (v) the valuation of existing portfolios, (vi) the risk management of institutions that hold debt instruments, and (vii) the pricing of mortgage portfolio servicing contracts.

BACKGROUND OF THE INVENTION

[03] By way of an introductory example, consider the most common of debt instruments, the consumer mortgage. The value of a mortgage depends, in large part, on the duration of the mortgage. At the inception of the mortgage there are broker

fees and various other settlement costs that are charged to the lender. When a mortgage extends for the term of many years, there is an opportunity for the lender to recoup costs of putting a mortgage in place for a given consumer and to make profit on that mortgage. This is particularly important for all business organizations that lend money, but it is particularly important for those mortgage financing organizations which have stockholders and other investors.

[04] When a mortgage loan is paid off early due to refinancing, depending upon how early in the term, the mortgage loan is paid off, there is the possibility that the lending institution can actually take a loss on the particular mortgage. The rate of prepayment depends on a number of objective factors. For example, during times of decreasing mortgage rates, on average, more consumers refinance their home loans than would otherwise occur, in order to obtain a lower monthly payment. However, for a given macroeconomic environment and other measurable, objective factors, each consumer evidences an individual propensity to prepay a loan. This prepayment propensity reflects the consumer's demographic and other objective attributes. A system that can assess such individual prepayment behavior by a consumer in advance of the loan will lead to more profitable loans being made, and hence the enhanced availability of funds for loans to more consumer-borrowers. The present invention therefore may be applied, without limitation, to a) the pricing of mortgages and other debt instruments, b) the valuation of existing portfolios of debt instruments, and c) the risk management of institutions that hold debt instruments.

[05] Additionally, the present invention is not limited to the type of debt instrument or lending transaction to which the prepayment score is useful. The invention includes,

but is not limited to, mortgages (consumer and commercial), second mortgages, refinanced mortgages, consumer loans, commercial loans, asset-backed loans, consumer leases, commercial leases, credit card accounts, credit card balance transfers, debt consolidation loans (term notes, etc.), mortgage-backed securities (i.e., mortgage pass through, CMO's, mortgage-backed bonds, principal-only, interest-only, etc.), and any servicing contract for these lending transactions that performs financially based on the quality (i.e., duration) of the cash flow.

[06] A further element of the present invention is the monitoring and scoring of brokers for these lending transactions. Mortgage brokers deal with both consumer-borrowers and lenders-clients. In order to generate brokerage fees, it is possible for a broker to encourage its consumer-borrowers to refinance their mortgages frequently and prematurely. When this occurs, the mortgage broker generates a fee for the broker, however, early prepayment of the prior mortgage instrument can result in a loss for the lender. Thus the present invention also has the capability to score mortgage broker prepayment behavior.

[07] The behavior of a broker is sometimes not all heinous. Sometimes a consumer, who is particularly attuned to the rise and fall of interest rates, will simply be the one who changes mortgage instruments more frequently than the average consumer. The broker who is scored based upon the prepayment behavior of the consumers that the broker brings to lenders, would like to know the pre-payment propensity for the given consumer. This would be useful so that the mortgage broker can optimize the broker's relationship with its lender-clients by only bringing consumer-borrowers who have a low prepayment propensity.

[08] Therefore, lenders and brokers badly need the ability to better measure prepayment behavior in advance of incurring marketing or underwriting charges; these expenses are too great to absorb blindly on behalf of consumers with poor prepayment propensities. Indeed, a beneficial use of the invention would be in managing the initial marketing effort itself. For example, only those customers who can be shown to score favorably for prepayment behavior might receive a solicitation for a mortgage product A. Consumers who are revealed to represent a substantial prepayment risk may be offered a more suitable mortgage product B, reflecting the increased risk. In this way, enhanced customers segmentation and product design initiatives converge to benefit consumers and their sources of debt financing, to the benefit of each.

[09] To understand the potential impact of national prepayment scoring standard, as manifested in the present invention, one need look no farther than the existing default risk scoring standard, owned and distributed by Fair, Isaac and Company, Inc. (Fair Isaac) for over 30 years. By establishing a standard methodology for scoring borrower default risk, and broadly disseminating it, Fair Isaac dramatically enhanced mortgage lender insight into expected loan dynamics. In finance, enhanced insight is synonymous with enhanced information. Enhanced information implies reduced risk for the lender. Finally, reduced lender risk profiles produce lower costs of capital. In other words, because Fair Isaac standardized successfully a fungible measurement of default risk, more money is available for consumers to borrow, at better and cheaper interest rates. The market is more efficient than before and everyone benefits.

[10] To further qualifying the timeliness of the invention, please refer to exhibit 1, "Green Tree chief returns \$23 million..." The Wall Street Journal, March, 1998. This story highlights the industry wide uncertainty surrounding prepayment speeds in consumer debt portfolios. One industry leading company, Green Tree Financial, "has been hit hard the past year by escalating loan losses in the painful recognition that its accounting has been too aggressive. Also, an unexpected wave of loan prepayments hit the industry, as borrowers sought lower interest rates, indicating working-class consumers were not as unsophisticated as lenders had believed." Stated plainly, Green Tree overstated prior year earnings significantly, exercising its option under GAAP accounting to roll forward and capture in advance projected lending profits, even though those very profits were merely estimated based in part on arbitrary prepayment assumptions. In large measure because Green Tree badly miscalculated these prepayments speed assumptions, in 1997 the company was forced to charge off \$390 million of 1996 reported profit. In 1998 the company was sold off to Conseco.

[11] Earlier disclosures in the area of prepayment scoring in a lending context are limited or nonexistent. United States Patent No. 5,696,907, entitled "System and Method for Performing Risk and Credit Analysis of Financial Service Applications," issued to Tom. The Tom patent discloses using a neural network to mimic a loan officer's underwriting decision making. The method of the Tom patent is based on a non-iterative regression process that produces an approval criterion that is useful in preparing new or modified underwriting guidelines to increase profitability and minimize losses for a future portfolio of loans. A prepayment observation is used in the neural net as a negative flag, but no prepayment scoring system is utilized in the

Tom patent.

- [12] In view of the prior art, there is a clear need for measuring and predicting a consumer's prepayment propensity, as well as a clear and strong need for a method and apparatus to produce such a measuring and predictive parameter.

BRIEF SUMMARY OF THE INVENTION

- [13] The system and method of the present invention generally works in the following manner: the service bureau or broker will electronically capture individual loan applications from consumers. Those loan applications will be sent to lenders for evaluation. The lender, using the present invention submits the loan application for review and analysis. The loan application will be reviewed by the present invention according to a sophisticated economic and customer behavior model, which will score the prepayment behavior of candidate borrowers. The score for these borrowers, which is an index of their prepayment propensity, will be electronically returned to the lender. The lender will in turn use the prepayment score and calibrate an appropriate mortgage price including the setting of interest rates, fees, broker commissions, and potentially consumer rewards. Using this consumer scoring technique, a lending institution can seek to contact or contract with those consumers who display a low propensity to prepay.

- [14] The advanced scoring of customer prepayment propensities materially improves the lender's to risk profile as regards new lending customers. This novel insight adds value to the marketing, underwriting, lending, administrative process for first and second mortgages, credit card balance transfers, and asset-backed term loans such as

automobile loans. By assisting lenders in their efforts to segment customers according to this crucial behavior metric, waste and excess costs are driven from the lending economy. More money is thus available, more cheaply, for more people.

[15] To the borrower, this system offers several advantages. First, more favorable loan terms can be made to those consumers who exhibit a beneficial borrowing behavior, i.e., borrowers who are not likely to prepay their loans but instead maintain their loans for a profitable duration. Further, dealing with a stable borrower market results in a more favorable financial environment on for all lenders thereby mitigating the risk of loss and, in the normal course of all efficient markets, passing that financial advantage onto borrowers generally.

[16] Once again, the irrefutable economic relationship between financial risk-taking and expected financial reward informs the environment addressed by the present invention. If lenders reduce their risks-and by extension their costs-through enhanced prepayment scoring, ultimate borrowing costs paid by consumers will decline.

[17] For the loan originator, the system offers several advantages. The loan originator can more efficiently price the particular loan. Further the loan originator can more efficiently select brokers and intermediaries who will select the best borrowers. Further, the system and method of the present invention will lead to more efficient direct and indirect marketing investments by identifying individual consumers and groups of consumers who exhibit the most beneficial borrowing behavior, i.e., a propensity not to prepay financial obligations.

- [18] Given that direct marketing costs are exploding as the conventional direct channels (e.g. mail and outbound telemarketing) become saturated, any available efficiency in the direct marketing process is highly desirable. For example, in the marketing of home equity lines of credit (i.e. second mortgages), direct-mail response rates are now, on average, running below 0.3% (i.e. below 3/10ths of one percent). Obviously, some fraction of even this small respondent sample will prove ill-suited, as regards prepayment behavior, for the debt product being marketed. Therefore, the tailoring of specific debt products to consumers of specific prepayment behavior characteristics is essential to the efficient pricing of debt instruments. Lead generation, third-party data acquisition, underwriting, yield spread calculations all directly inform debt instrument profitability, and are all beneficially affected by the present invention.
- [19] Finally, in the context of sophisticated asset liability management (ALM), subtle prepayment behavior analysis provides significant benefits to its practitioners. Because ALM, as a primary objective, seeks to minimize destructive asymmetries in asset and liability cash flows, intelligent risk managers will utilize debt contracts of varying expected durations to strengthen their balance sheet. For example, a lender's risk manager may seek multiple classes of debt instrument, reflecting multiple prepayment profiles, in order to assure himself of adequate incoming cash flow to sustain his expected liability cash outflows. In the matching, therefore, of expected cash in- and out-flows, the prudent risk manager utilizes a carefully segmented portfolio of debt instruments scored by prepayment propensities (and other measures) and priced accordingly, to avert liquidity crises.

- [20] An additional, equally valuable use of the present invention is in the valuation of existing mortgage or debt instrument blocks of business. This valuation may be required by lender risk managers, auditors, regulators, or investors; it may reflect stakeholder interest in actively managing asset-liability risk, or it may be performed as part of the merger and acquisition appraisal. In all instances, the prepayment scoring system quantifies from a granular perspective upward to a pool, or block perspective, the prepayment speed characteristics of the debt instruments. As we have seen in the Green Tree case, failing to adequately price prepayment risk has enormous balance sheet implications, and typically leads one to grossly over value a portfolio or the enterprise itself.
- [21] For auditors, the system of the present invention offers a quantitative measure of prepayment risk thus reducing auditor exposure to "claw-back" write-downs. This situation occurs in the case of issuers that secure these mortgages and, under the generally applied accounting procedures (GAAP) accelerate and capture earnings based on certain prepayment assumptions. If those prepayment assumptions are incorrect, prior year financial statements are incorrect and massive charges are required to reflect lower portfolio earnings.
- [22] For banking regulators, the system of the present invention offers the ability to quantify balance sheet risk resulting from expected consumer prepayment behavior. This will allow regulators to more precisely measure and assign minimum bank capital levels.
- [23] For credit rating agencies, the ability to score according to an objective, standard

methodology prepayment risk provides enormous assistance in rating a lender's creditworthiness. Rating agencies function, effectively, as credit market bellweathers. Lending institutions are dependent on favorable credit ratings in order to float their institutional debt at advantageous rates; rating agencies, as in the case of regulators, evaluate carefully lenders' claims of capital adequacy; the capital (cash reserves) retained by lenders is directly and immediately affected by debt instrument prepayment speeds. This is because, under GAAP accounting rules, lenders are allowed to capture a substantial percentage of the future expected profits for a given contracted debt instrument, and those profits are themselves substantially dependent on the assumed life of the instrument. (In the case of subprime mortgages, for example, profits may double if the mortgage is maintained in force for four years instead of three). If those profits are overstated, they must be reversed, with resultant charges reducing lender capital (capital: paid-in cash investments plus retained profits). Therefore, rating agencies must scrutinize lender portfolio prepayment speed assumptions, because if those assumptions prove false, then the lender will suffer a reduction in capital. Any significant impairment of lender capital necessarily suggests a reduction in its credit rating. Credit rating agencies will be major beneficiaries and users of the present invention.

- [24] For investment bankers, the system of present invention establishes a standardized prepayment methodology that allows merger and acquisition advisers to be able to quantitatively measure the balance sheet risk in a target banking or mortgage company. In addition, investment bank usage of the present invention will include its application to debt instrument securitization. Securitization describes the process

by which pools of mortgage or other debt instruments are purchased by investment banks-in their capacity as underwriters-and re-sold to institutional and public investors as reconstituted securities. Typically, these securitizations benefit originators of debt, because they realize significant acceleration in realized profits; they also significantly diversify their risks by selling significant aspects of the debt instrument to asset underwriters and others. However, the typical debt instrument securitization proceeds with the originating lender retaining significant prepayment risk; if prepayment speeds accelerate beyond levels assumed in the securitization pricing process, the originating lender is held responsible. Hence the invention, by measuring the expected prepayment behavior and scoring in according to an accepted, industry standard method, will improve the securitization process and render it more efficient. Once again, this will reduce costs for all participants and free up more capital for lower-cost consumer borrowing.

[25] For investors, the method of the present invention provides a way to make investment decisions based upon quantified debt instrument prepayment behavior risk for lending institutions in which investors might want to invest; or to evaluate the relative stability of mortgage securities that are backed by individual debt instruments.

[26] These and other advantages of the present invention are described in reference to the specification that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[27] **Figure 1** is an overview of the process of the present invention.

- [28] **Figure 2** is a block diagram of the present invention.
- [29] **Figure 3** is a block diagram showing the user interface module connections.
- [30] **Figure 4** is block diagram showing the interactions with the prepayment historical data.
- [31] **Figure 5** is a block diagram showing the interactions with the econometric model.
- [32] **Figure 6** is a block diagram showing the factors that are used by the user interface module.

DETAILED DESCRIPTION OF THE INVENTION

- [33] Referring to **Figure 1**, an overview of the process of the present invention is shown. The mortgage broker or lending institution first obtains a loan application from a borrower **10**. That information is electronically transmitted to the present invention, which parses the information **12** of the loan application into various categories that are relevant to the scoring of the potential loan. The loan application contents are parsed based upon the information needs of a sophisticated, mathematical model resident in the present invention. A prepayment score is then derived **14** for the particular consumer as a function of the particular loan type being requested, and in further view of the interest rate environment in which the loan is being processed (i.e. rising or falling interest rates). As previously noted this score is an indication of the prepayment propensity of a particular consumer. The prepayment score is then returned to the lender **16**. Thereafter the lender can create a customized loan product that rewards favorable prepayment behavior of the

consumer 18.

[34] Referring to **Figure 2**, an overview of the system of the present invention is shown. A loan originator **20** receives the application from a potential consumer. That application is then input to the loan originator's data delivery channels **22**. Such data delivery channels **22** are (without limitation) e-mail, fax, Internet, and generally other electronic means. Other loan originators **34** also send their respective consumer applications over their own data delivery channels **36**.

[35] The present invention anticipates delivery of loan applications **24** over the Internet **28** or other digital electronic means such as wireless communications methods as well. Electronic loan applications **40** enter the system of the present invention through a communication server **42**. The loan information concerning a given consumer is then submitted to an application parser **52**. Application parser **52** divides the information into loan information **58** and applicant information **56**. Loan information **58** is information that relates to the amount, the term, down payment, loan type, and other information important and relating to the amount of money to be loaned. Applicant information **56** is information such as name, address, Social Security number, and other demographic information concerning the applicant.

[36] Loan information **56** is fed into a prepayment model library database **66**. The prepayment model library database **66** comprises information concerning prepayment historical data **62**. The results are fed into model training server **64** which processes prepayment historical data **62** of both an individual and demographic groups which in turn provides updates to the model library database **66**.

Once loan information 58 is processed by the prepayment model library database 66 an analytical prepayment model 60, which is based upon the loan information 58 is provided to the prepayment calculation server 46. Prepayment calculation server 46 receives additional information from econometric model 48 which establishes the relationship among the wide variety of variables. Econometric model 48 generates interest rate, mortgage rate and other economic parameters that, arrayed in time series, comprise scenarios utilized by the prepayment calculations server. These scenarios are generated from the Low Discrepancy Sequence (LDS) logic, rather than using random number generation. The LDS logic affords significantly higher model accuracy with the same number of scenarios.

[37] Once a prepayment score 44 is derived by prepayment calculation server 46, prepayment score 44 is sent to the communication server 42 and is transmitted over the Internet (or other electronic channels) 28 through the data delivery channels 22 or 36 back to loan originators 20 or 34 who can then either approve, disapprove, or create customized loan product for the consumer.

[38] Prepayment score 38 is calculated based upon the following model. The specific prepayment analysis of the present invention is conceptually shown below.

[39] The following variables:

[40] $A = (a_1, a_2, \dots, a_n)$

[41] $L = (l_1, l_2, \dots, l_m)$

[42] are vectors of the applicant's data and loan parameters.

[43] $E_s(t) = (e_{1s}(t), e_{2s}(t), \dots, e_{ks}(t)); \quad s = 1, \dots, S$

[44] denotes a set of Low Discrepancy Sequence (LDS)-based scenarios of the econometric parameters, which have been generated by the RTH Linked Index Econometric Model. Thus the model is a set of stochastic differential equations that describe the dynamics and interaction of major macroeconomic indicators, each relevant to the prepayment propensity calculation.

[45] Analytical Prepayment Model \mathfrak{R} , which varies with the types of loan applied for, is trained to calculate prepayment value p_s in a given scenario based on the applicant's data (A), loan parameters (L), and econometric parameters (E):

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

[46] Total prepayment, accumulated by the time T in scenario s , can be calculated as:

$$P_s(T) = \prod_i p_s(t_i)$$

[47] Then, total prepayment at time T is given by:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

[48] Finally, the prepayment score is:

$$Score = \sum_T TP(T)$$

[49] The analytical model that produces the prepayment score may be further informed

by additional external behavioral or econometric factors, based on subsequent research, as well as the aforementioned behavioral scoring of mortgage broker behavior.

[50] The present invention may also be represented in an alternative embodiment in the form of the credit engineering workstation (CEW). This CEW (more fully described below) comprises a user interface which allows a loan originator to conduct all of the prepayment calculations, model analysis, and pricing of the present invention using the prepayment model first noted above.

[51] The CEW operates in either a Unix or Windows NT environment using Oracle, SQL server, Sybase, DB2, or Informix database support. The CEW also uses CORBA or, structured object models together with a JAVA/HTML browser based graphical user interface.

[52] The subroutines of the CEW all contribute to the end goal of determining the prepayment propensity of a consumer. For example, subroutines of the present invention deal supports the generation of various interest rate scenarios, and subsequent economic scenarios model fitting processes that fit the modeled interest rates scenarios to historical and current interest rate yield curve performance as well as to other macro economic indicators.

[53] Part of the system includes rewards pricing logic to efficiently measure and price the impact of rewards on consumer prepayment behavior. For example it would be most beneficial to a lender to reward the consumer for not prepaying the lender's loan. Such a reward could be assessed in terms of its impact on the consumer

prepayment behavior. The system therefore permits the end-user to design pro forma rewards structures and to test their impact on prospective consumer prepayment behavior.

[54] Various user definable screens also establish default spreads, prepayment spreads, broker commission schedules, and other financial factors that influence the pricing of the product to be offered to the consumer. Various other economic scenarios are collected via the user interface and combined with various probabilities and default data as well as other lender defined criteria result in rationally priced end-user mortgage contracts.

[55] Referring to **Figure 3**, further information concerning the CEW of the present invention shown. The system comprises user interface module **70** which is the basic graphical user interface and other software that allows an originator to provide information concerning a consumer who wishes to borrow money from lender. The user interface module allows the collection of loan attributes **76**, applicant attributes **74**, and reward program attributes **72**. In addition user interface module **70** collects or calculates spreads, broker commissions and other costs associated with the loan **78**. Loan attributes **76** and other loan related costs are fed into pricing engine **84** which, with other information, assists in creating an appropriate loan price **86**.

[56] Loan attributes **76**, applicant attributes **74**, and reward program attributes **72** all which have an impact on the value of the loan are fed into prepayment calculation server **80**. Prepayment calculation server **80** receives input from the various prepayment model parameters and creates prepayment score **82**.

[57] Referring to **Figure 4**, a block diagram showing the interactions which are necessary to create a prepayment model are shown. Consumer information **96** which consists of applicant attributes **74** and loan attributes **76** are fed into a prepayment model fitting **92** module. Prepayment model fitting **92** establishes various prepayment model parameters **94** based upon prepayment historical data **90**. Once the appropriate prepayment model is created by prepayment model fitting **92**, a model is returned to the prepayment calculation server for the calculation of the prepayment score of the particular consumer given the type of loan to consumer is requesting. The prepayment calculation server also benefits from input from an econometric model scenario generator.

[58] Referring to **Figure 5**, the interactions for the econometric model are shown. Econometric model scenario generator **106** receives input from econometric model fitting module **104** and LDS scenarios **108**. Econometric model fitting module **104** receives information from econometric historical data **100** and current market environment **102** which comprises, without limitation, information concerning rising or falling interest rates and trends. The information from econometric historical data **100** concerns the demographic group to which the consumer belongs and other econometric information such as age, income, credit rating, occupation and other factors. The information from current market environment **102** concerns the direction and velocity of changes to interest rates. Econometric model scenario generator **106** processes the information and produces various scenarios based on the information.

[59] Referring again to **Figure 3**, prepayment calculation server **80** creates prepayment score **44** for the particular consumer in question. Prepayment score **44** is based upon

the established prepayment model and the generated econometric model.

Prepayment score **44** is transmitted to the pricing engine **82** to establish the pricing of the loan product to be offered to the consumer in question.

[60] Referring to **Figure 6**, additional parameters which the user interface module uses to create the various scenarios are shown. Additional aspects of the present invention provide for creation of new products. Strategy optimizer **122** is based upon acceptance of offered products by consumers and input from and relating to other products are on the market. Strategy optimizer **122** generates marketing plans based upon individual lenders' portfolios. Such a market plan could assist the lender in offering new products to the marketplace that are more profitable for the lender. The system includes targeting optimizer **124** which provides a way to offer loan products to those consumers having the most favorable prepayment characteristics, i.e., a low propensity to prepay loans made. The system also comprises loyalty optimizer **126** which models and defines offers and other inducements to consumers to reward financially advantageous consumer behavior. Channel optimizer **128** is part of the present invention. Channel optimizer **128** analyzes the channels of delivery of financial product offerings to evaluate and determine the channel that is the most efficient way to deliver various financial products. The system also comprises database optimizer **130** which receives and organizes information in the various databases to constantly build and refined prepayment historical data **90** and econometric historical data **100**.

[61] The target platform on which the system of the present invention will run is either an Intel Pentium processor based system with typically 32 megabytes of RAM, hard

disk storage and retrieval, and communications capability using the TCP/IP protocol. Alternatively the system will also run under the UNIX operating system on a Sun Solaris platform. In both cases displays for users are anticipated as is the ability to output hard copy reports. In typical operation, a plurality of users, remote from the system site will access the system via private networks or over the Internet to send the information necessary for the present invention to make the desired calculations leading to the prepayment score. This score is then sent back to the requesting user at the remote terminal.

[62] Although described herein with respect to a mortgage loan or loan, the present invention is applicable to numerous financial instruments that have a value that depends on the particular consumer's actions over time. The value of typical debt instruments, such as, but not limited to, mortgages, second mortgages, home equity loans, car loans, school loans, term loans, leases, credit card accounts, and credit card balance transfers, depend on a continued stream of cash and are therefore affected significantly by prepayment.

[63] The value of other instruments that depend on the cash stream over time, such as open-end car leases and whole-life insurance policies, can also depend on the consumer's actions, and therefore, for purposes of this invention can be considered as a form of debt instrument. In the car lease scenario, predicting the probability of a consumer electing to purchase or return the car before the end of the lease (prepay) is important in determining the value of the lease. Even a consumer's predisposition to keeping (purchasing at residual value price, a type of prepayment) or returning the car at the end of the lease can be used to modify the lease terms to the leasing entity's

advantage.

[64] Likewise, the likelihood of a consumer to cash out the surrender value of a whole-life insurance policy (another form of prepayment, albeit in the opposite direction, that ends the stream of cash) can significantly affect the ultimate value of the policy to the insurer.

[65] Known database and computer-based data mining techniques can be used for analyzing: the value of financial instruments (and portfolios in which they are packaged) based on the prepayment score associated with each of them; the risk associated with portfolios containing the financial instruments; and the pricing for servicing those portfolios. Additionally, instruments can be packaged together into portfolios based, at least in part, on the prepayment scores of the applicants.

[66] A system and method for prepayment score generation has been described. Those skilled in the art will appreciate that other variations of the present invention are possible without departing from the scope of the invention as described.

WHAT IS CLAIMED IS:

[c1] A system for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:

at least one debt instrument origination computer terminal for accepting and transmitting a debt instrument application of an individual applicant;

a computer network connected to the at least one debt instrument origination computer terminal for receiving the transmitted debt instrument application of the individual applicant;

a communication server connected to the computer network for receiving the transmitted debt instrument application of the individual applicant;

an application parser connected to the communications server for receiving the transmitted debt instrument application of the individual applicant from the communications server and parsing the information into debt instrument information and applicant information;

a prepayment model library database comprising debt instrument prepayment models connected to the application parser for receiving the debt instrument information and fitting the debt instrument information into the debt instrument prepayment models and for transmitting debt instrument prepayment models that match the debt instrument information; and

a prepayment calculation server comprising a prepayment score generation model connected to the prepayment model library database for receiving the debt instrument

prepayment models and calculating a prepayment score for the debt instrument application of the individual applicant based upon the debt instrument prepayment model and the prepayment score generation model, the prepayment calculation server being further adapted to transmit the prepayment score to at least one debt instrument origination computer terminal via the communications server and the computer network;

where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment; and

wherein the at least one debt instrument origination computer terminal is adapted to use the prepayment score to adjust terms of the debt instrument of the individual applicant.

[c2] The system for determining a prepayment score of claim [c1], where the prepayment model library database further comprises:

a model training server for creating the debt instrument prepayment models for the prepayment model library database; and

prepayment historical data storage means connected to the model training server, the prepayment historical data further comprises prepayment statistics regarding debt instruments of various types.

[c3] The system for determining a prepayment score of claim [c1], where the prepayment calculation server further comprises an econometric model that

generates Low Discrepancy Sequence (LDS)-based scenarios of econometric parameters for input to the prepayment calculation server.

- [c4] The system for determining a prepayment score of claim [c1], further comprising means adapted to calculate a total prepayment at time T from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

- [c5] The system for determining a prepayment score of claim [c4], further comprising means adapted to calculate the total prepayment, accumulated by time, in scenario s from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

- [c6] The system for determining a prepayment score of claim [c5], further comprising means adapted to calculate the prepayment value in a given scenario from the formula:

$$p_s(t) = \Re(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \Re is an analytical prepayment model.

- [c7] The system for determining a prepayment score of claim [c1], where the applicant is either an individual consumer or an individual household.
- [c8] The system for determining a prepayment score of claim [c1], further comprising computer-based means for using data associated with the prepayment score of the applicant and terms of the debt instrument to determine a calculation selected from the group consisting of: a value of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.
- [c9] A method for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:
- collecting debt instrument and applicant information at a debt instrument originator;
 - transmitting the debt instrument and applicant information over a network;
 - receiving the debt instrument and applicant information at a service bureau;
 - the service bureau calculating a prepayment score the individual applicant, where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment;

the service bureau returning the prepayment score over the network to the debt

instrument originator; and

the debt instrument originator using the prepayment score to customize a debt instrument product for the individual applicant.

- [c10] The method for determining a prepayment score of claim [c9], where calculating a prepayment score for the applicant comprises parsing the information into debt instrument information and applicant information.
- [c11] The method for determining a prepayment score of claim [c10], further comprising providing the applicant information to a prepayment model library database and the debt instrument information to a prepayment calculation server.
- [c12] The method for determining a prepayment score of claim [c11], further comprising the prepayment model library determining the prepayment model that best applies to the debt instrument information and providing that prepayment model to the prepayment calculation server.
- [c13] The method for determining a prepayment score of claim [c12], further comprising the prepayment calculation server receiving a prepayment model and an econometric model, where the prepayment calculation server further calculates a prepayment score for the applicant.
- [c14] The method for determining a prepayment score of claim [c13], where the total prepayment at time T is calculated from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

[c15] The method for determining a prepayment score of claim [c14], where the total prepayment, accumulated by time, in scenario s is calculated from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

[c16] The method for determining a prepayment score of claim [c15], where the prepayment value in a given scenario is calculated from the formula:

$$p_s(t) = \Re(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \Re is an analytical prepayment model.

[c17] The method for determining a prepayment score of claim [c9], where the applicant is defined as an individual consumer or an individual household.

[c18] The method for determining a prepayment score of claim [c9], further comprising rating a broker based on prepayment scores of applicants that are clients of said broker.

[c19] The method for determining a prepayment score of claim [c9], further comprising using the prepayment score of the applicant and terms of the debt instrument to assist in determining a calculation selected from the group consisting of: a value

of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c20] The method for determining a prepayment score of claim [c9], further comprising packaging said debt instrument into a portfolio based, at least in part, on the prepayment score of the applicant.

Abstract of the Disclosure

A method and apparatus is disclosed for determining the prepayment propensity of individual borrowers. Early payment of debt instruments, such as loans and leases, can lead to losses being suffered by lenders. The present invention analyzes the demographics associated with a particular borrower to determine both the individual and group based prepayment propensity. The history of the borrower, the history of the borrower's demographic group, interest rate trends and other factors are then used to calculate a prepayment score that can be used by the lender to determine the propensity of a given borrower to prepay the instrument in question. The score of the individual borrower can be used to estimate the profitability of a debt instrument and allow the lender to make appropriate adjustments prior to issuing the instrument. The individual prepayment scores of a lender's or broker's clients can also be used to rate the lender or broker.

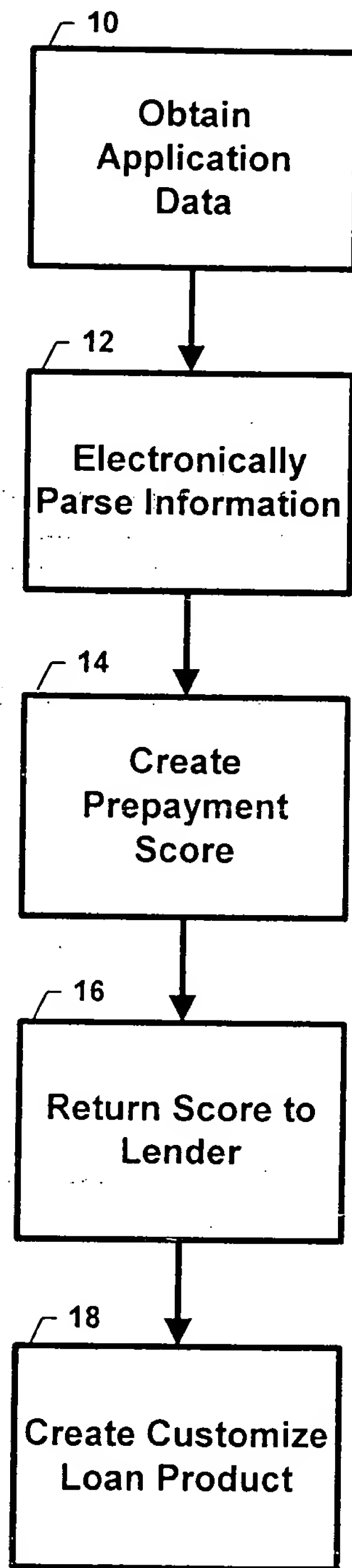


FIGURE 1

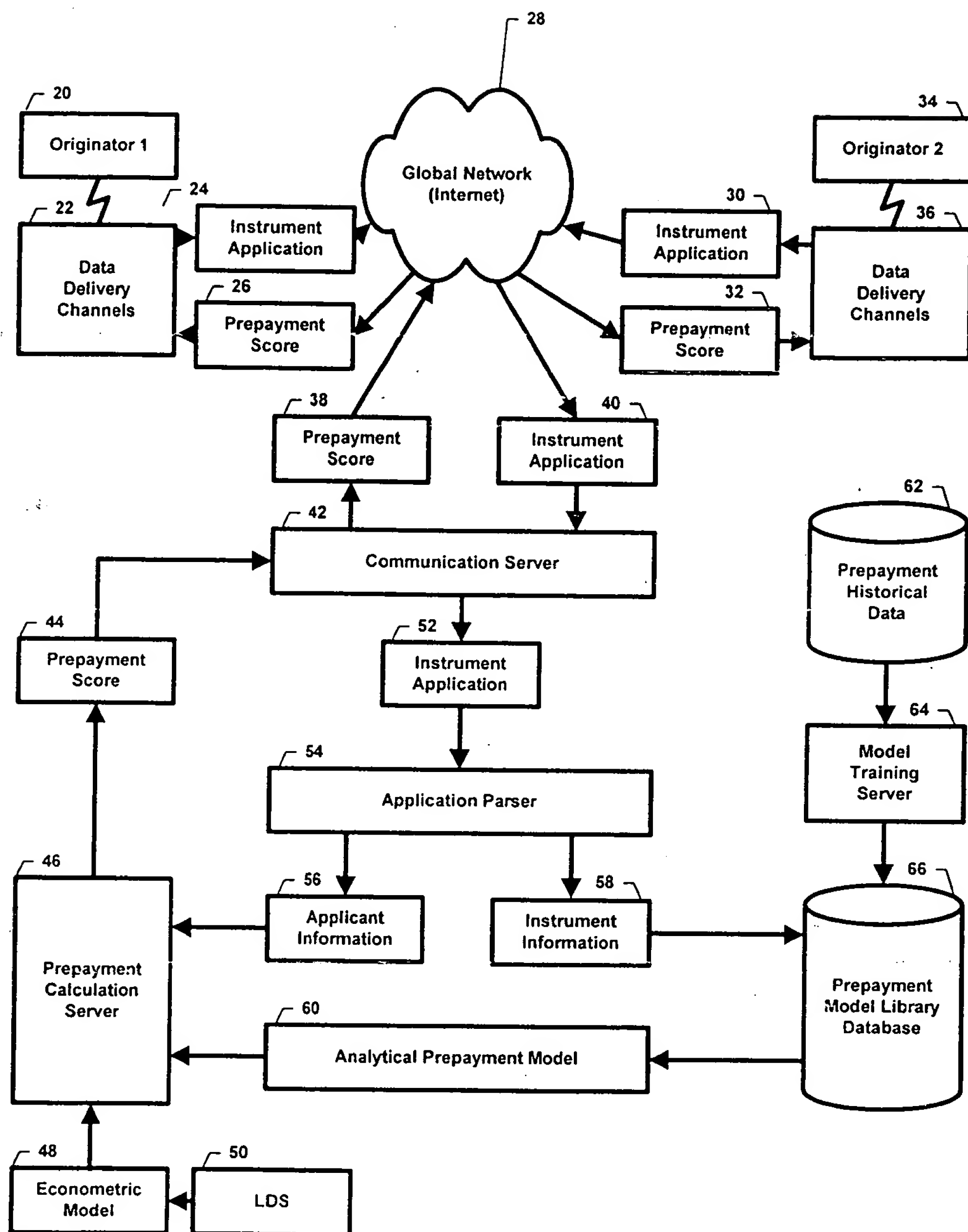


FIGURE 2

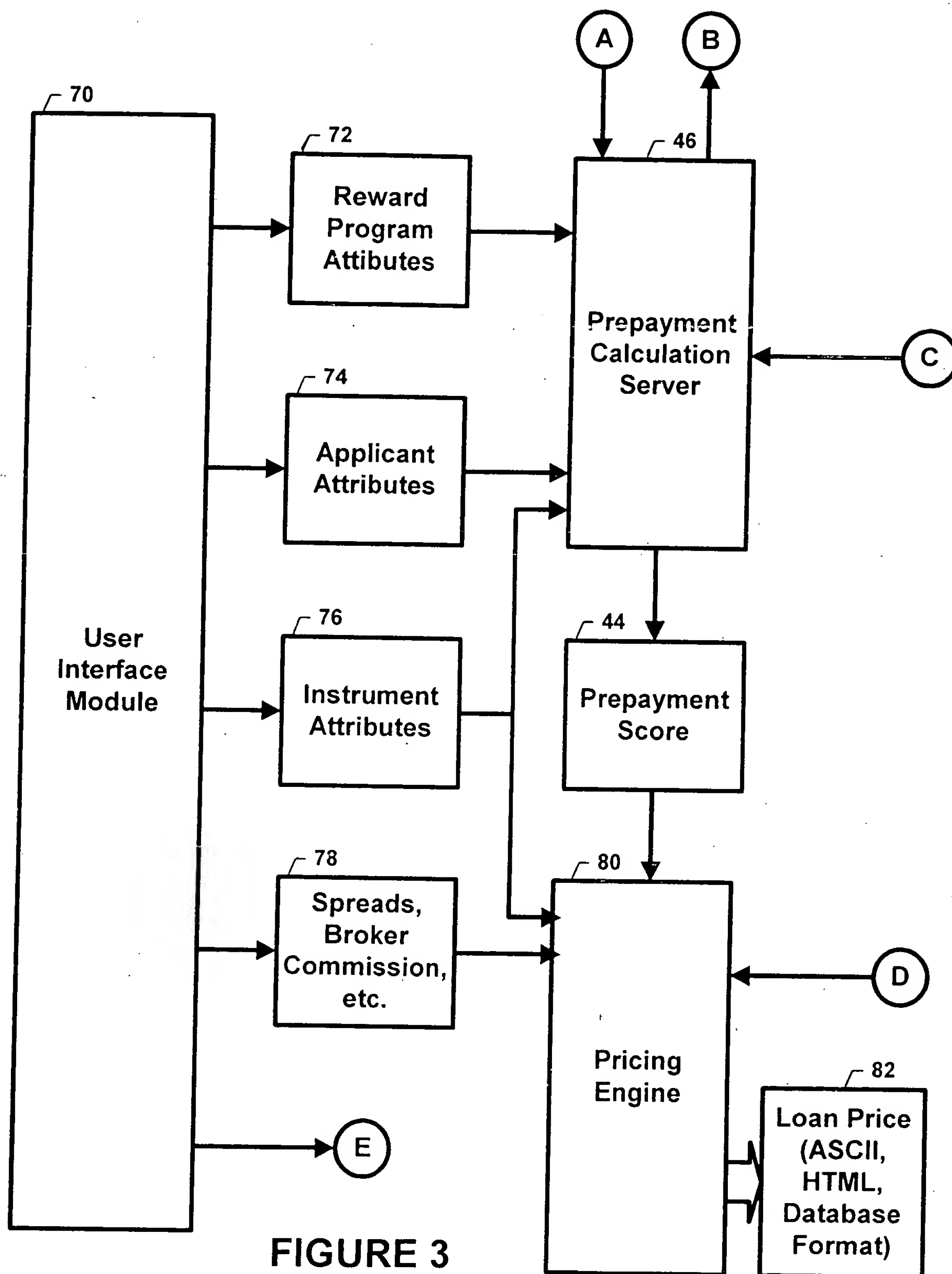


FIGURE 3

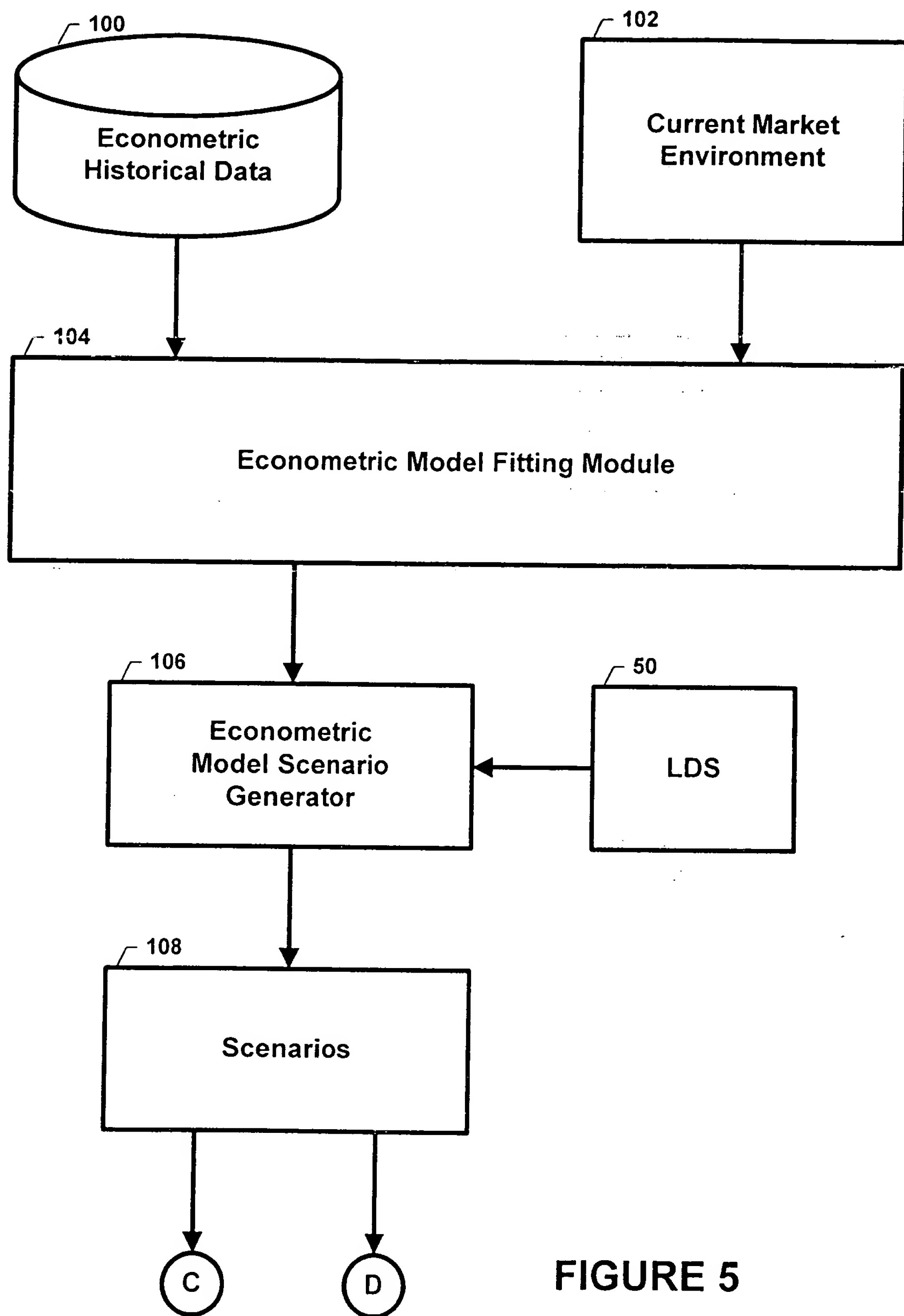


FIGURE 5

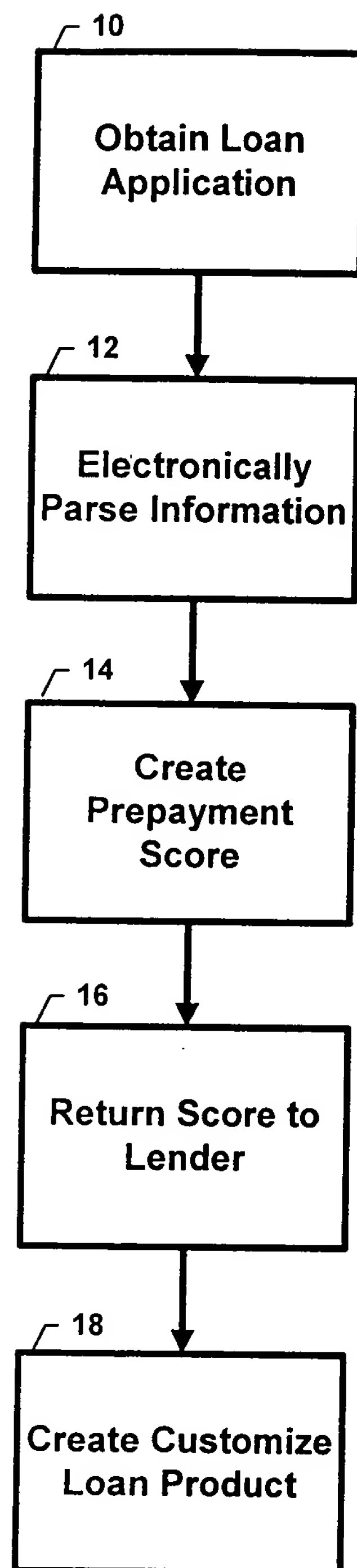


FIGURE 1

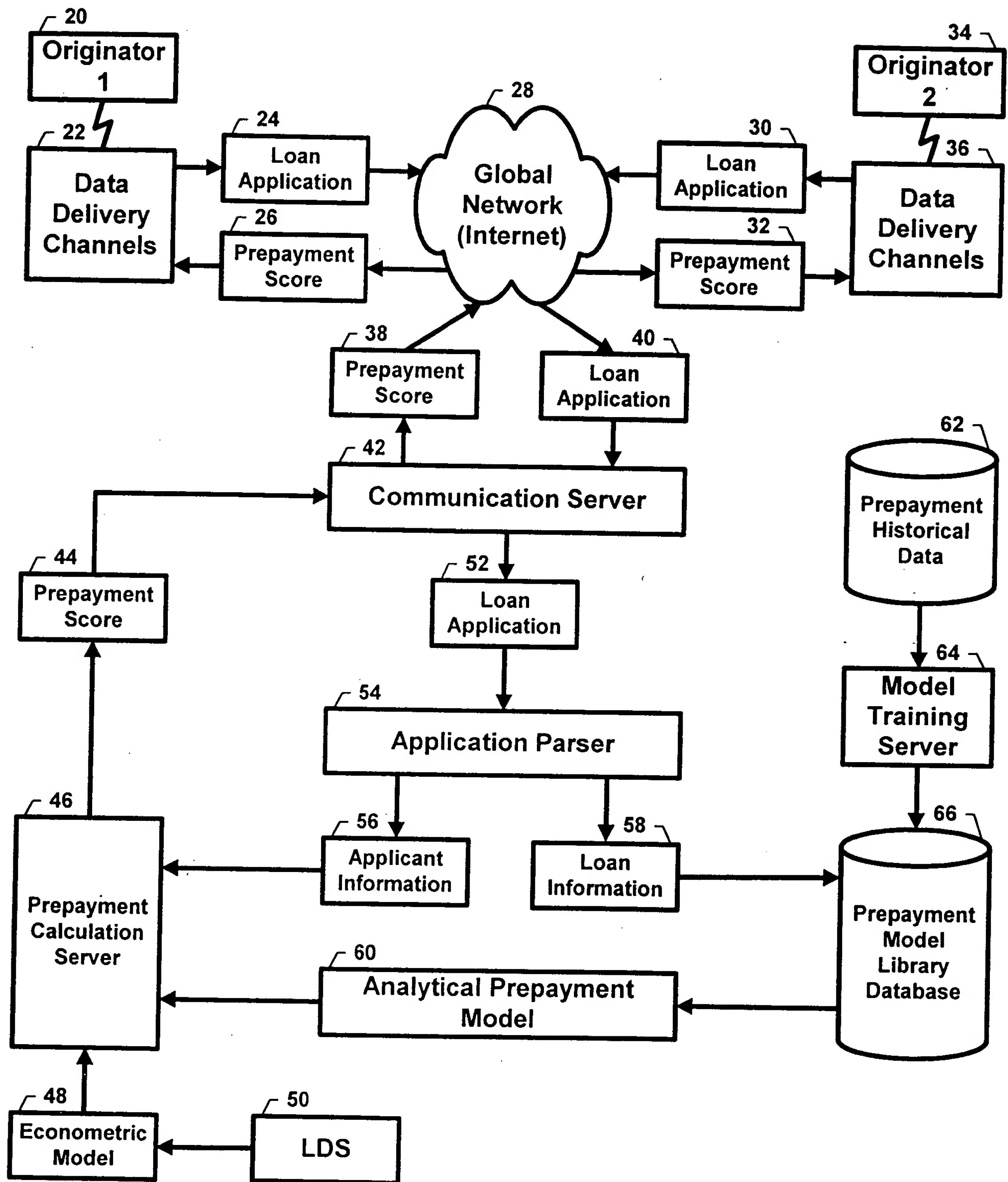


FIGURE 2

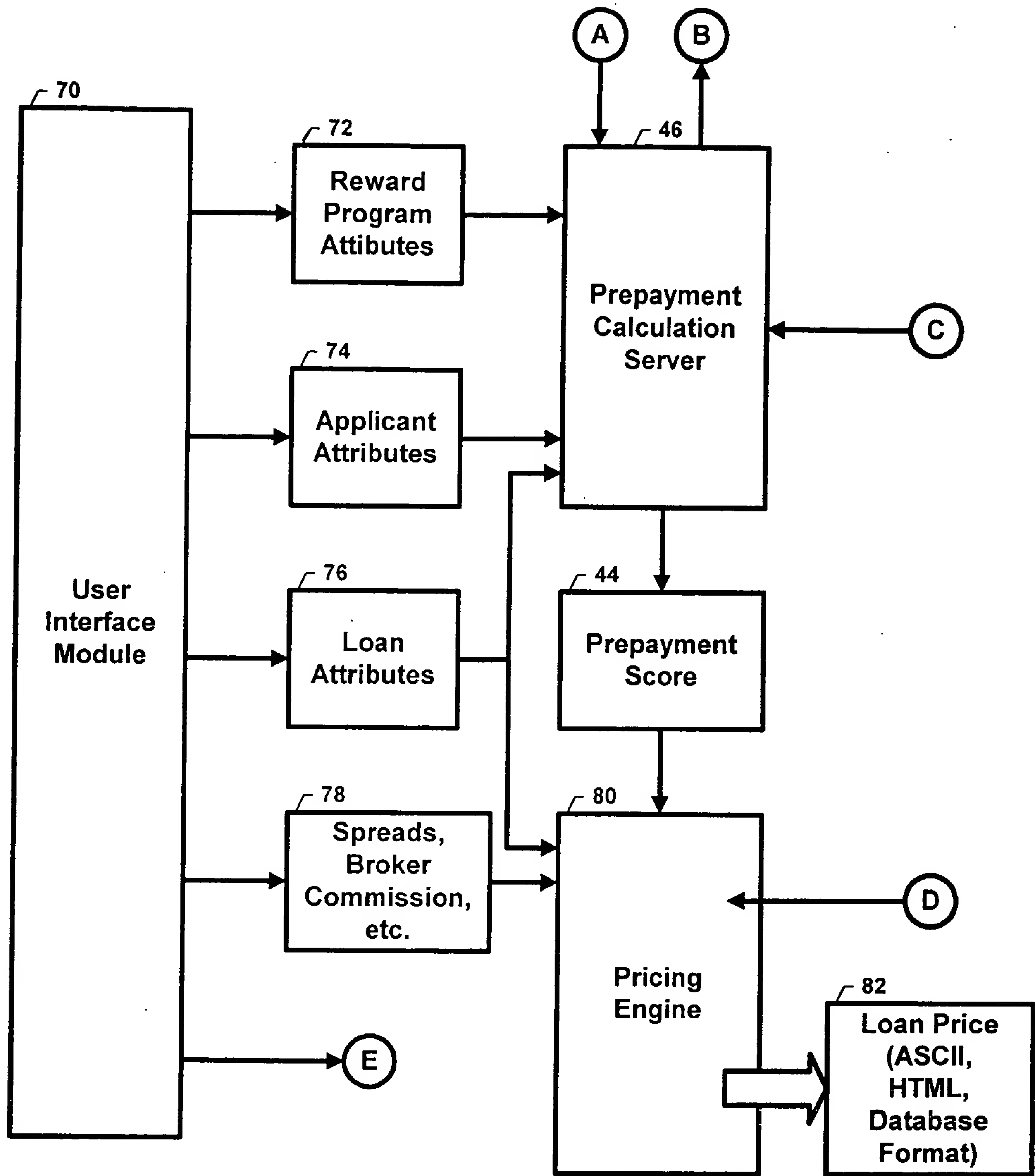


FIGURE 3

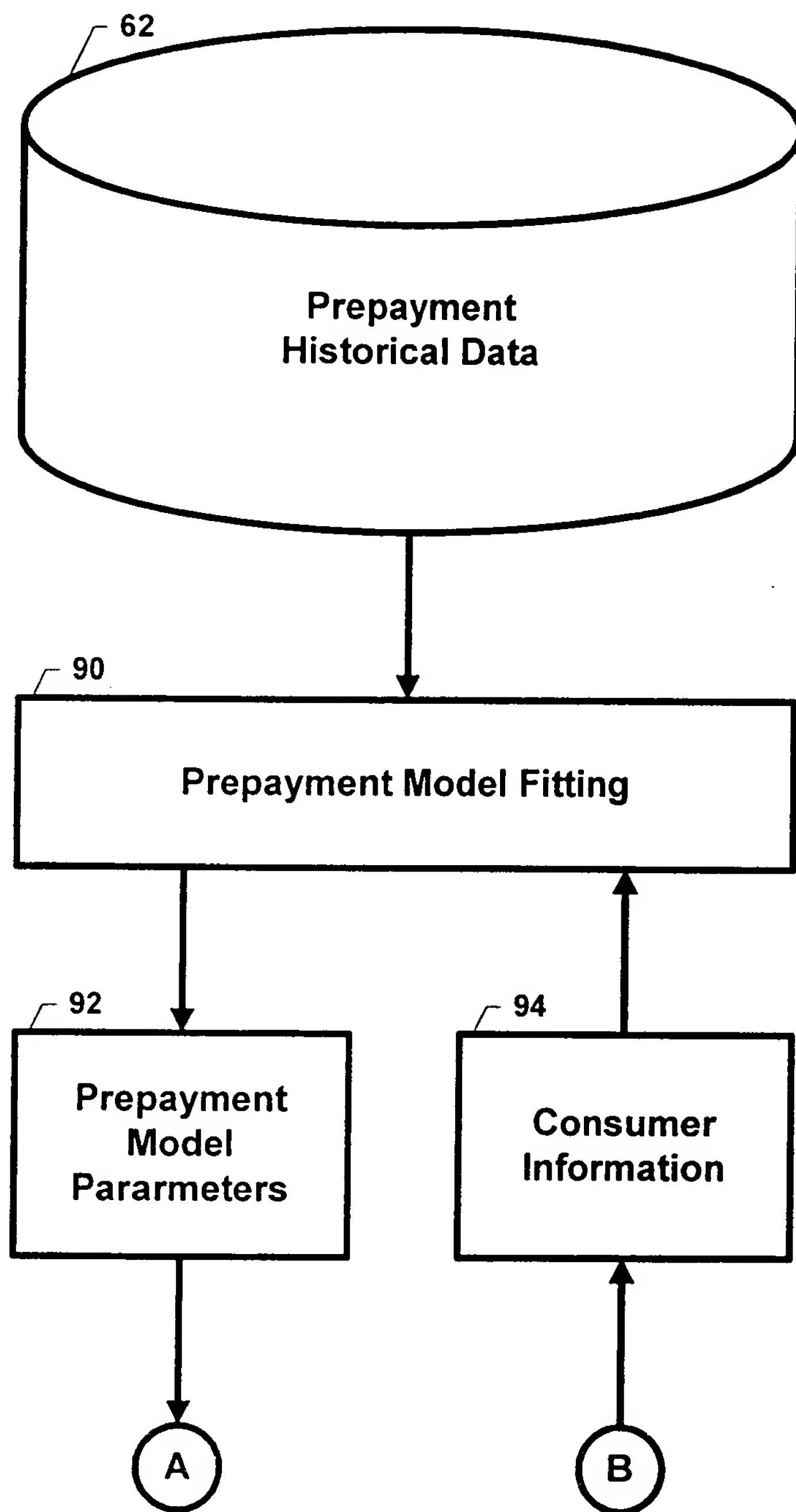


FIGURE 4

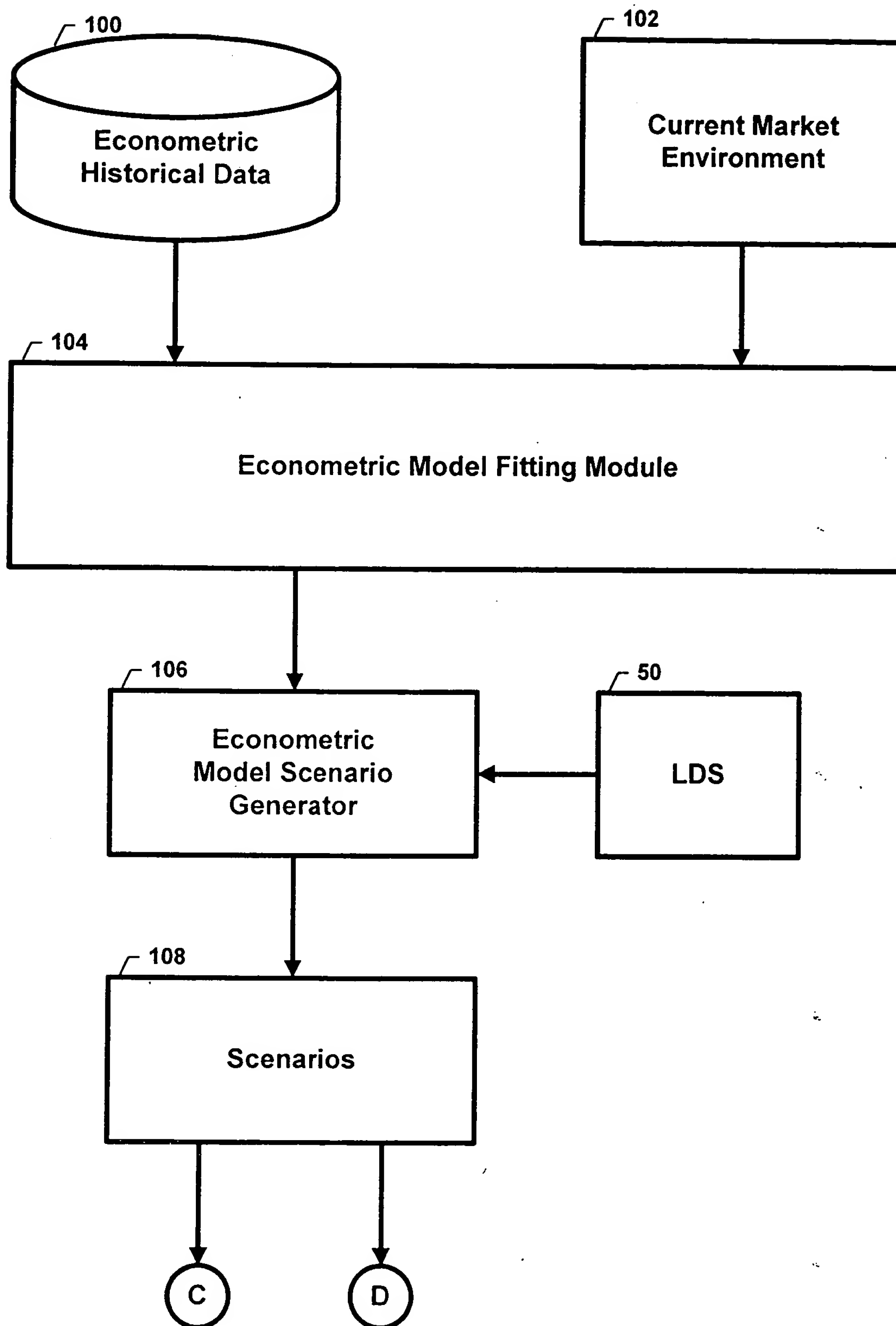


FIGURE 5

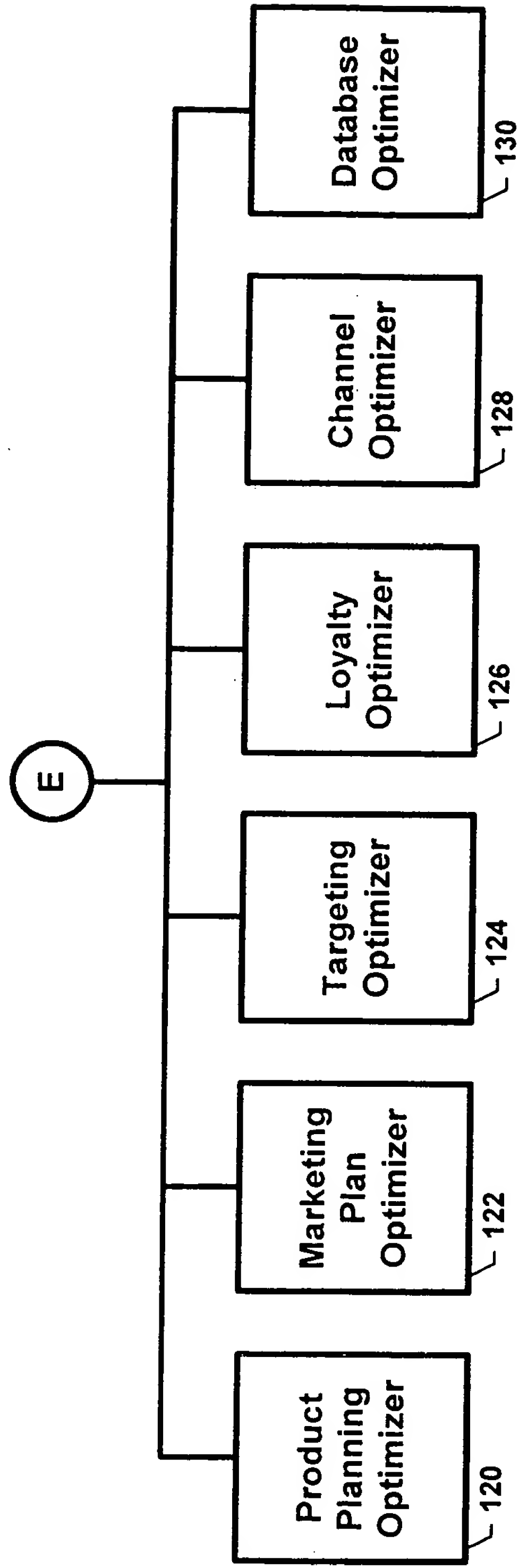


FIGURE 6

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Yuri Galperin, et al.
Appl. No.	: 09/942,983
PCT Filing Date	: August 30, 2001
For	: METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT
Examiner	: Siegfried E. Chencinski
Group Art Unit	: 3692

STATEMENT OF CHARLES L. JONES III UNDER 37 C.F.R. § 1.48(a)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Charles L. Jones III, do declare as follows:

1. I am a citizen of the United States and reside at _____.
2. The above-referenced patent application was filed on August 30, 2001 listing Yuri Galperin, Vladimir Fishman and William A. Eginton as the joint inventors.
3. I believe that I, Charles L. Jones III, should also be named as an inventor in the above-referenced application.
4. The inventorship error occurred without deceptive intent on my part.

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or document, or any registration resulting therefrom.

Dated: _____

Charles L. Jones III

ASSIGNMENT

WHEREAS, I, Charles L. Jones III, residing at _____, am a joint inventor, along with Yuri Galperin, Vladimir Fishman, and William A. Eginton, of certain new and useful improvements in a METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT for which we have filed an application for Letters Patent in the United States, Application No. 09/942,983 Filed on August 30, 2001;

AND WHEREAS, MarketSwitch Corporation (hereinafter "ASSIGNEE"), a Delaware corporation, with its principal place of business at 2350 Corporate Park Drive, Suite 400, Herndon, VA 20171, desires to acquire the entire right, title, and interest in and to said improvements and said Application:

NOW, THEREFORE, in consideration of the sum of One Dollar (\$1.00) to me in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, I, said inventor, do hereby acknowledge that I have sold, assigned, transferred and set over, and by these presents do hereby sell, assign, transfer and set over, unto said ASSIGNEE, its successors, legal representatives and assigns, the entire right, title, and interest throughout the world in, to and under said improvements, and said application including all provisional applications relating thereto (including but not limited to U.S. Provisional Application No(s). 60/228,954, filed August 31, 2000 (respectively if plural applications)), and all divisions, renewals and continuations thereof, and all Letters Patent of the United States which may be granted thereon and all reissues and extensions thereof, and all rights of priority under International Conventions and applications for Letters Patent which may hereafter be filed for said improvements in any country or countries foreign to the United States, and all Letters Patent which may be granted for said improvements in any country or countries foreign to the United States and all extensions, renewals and reissues thereof; and I hereby authorize and request the Commissioner of Patents of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents on applications as aforesaid, to issue all Letters Patent for said improvements to said ASSIGNEE, its successors, legal representatives and assigns, in accordance with the terms of this instrument.

AND I DO HEREBY sell, assign, transfer, and convey to ASSIGNEE, its successors, legal representatives, and assigns all claims for damages and all remedies arising out of any violation of the rights assigned hereby that may have accrued prior to the date of assignment to ASSIGNEE, or may accrue hereafter, including, but not limited to, the right to sue for, collect, and retain damages for past infringements of said Letters Patent before or after issuance.

AND I HEREBY covenant and agree that I will communicate to said ASSIGNEE, its successors, legal representatives and assigns, any facts known to us respecting said improvements, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuing and reissue applications, make all rightful oaths and generally do everything possible to aid said ASSIGNEE, its successors, legal representatives and assigns, to obtain and enforce proper patent protection for said improvements in all countries.

IN TESTIMONY WHEREOF, I hereunto set my hand and seal this ____ day of _____, 20__.

Charles L. Jones III

STATE OF }
 } ss.
COUNTY OF }

On _____, before me, _____, notary public, personally appeared **Charles L. Jones III** personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged to me that he executed the same in his authorized capacity(ies), and that by his signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

[SEAL]

Notary Signature

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Second inventor: **Vladimir Fishman**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Third inventor: **William A. Eginton**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Fourth inventor: **Charles L. Jones III**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: _____

Mailing Address: same as above

Send Correspondence To:
KNOBBE, MARTENS, OLSON & BEAR, LLP
Customer No. 20,995

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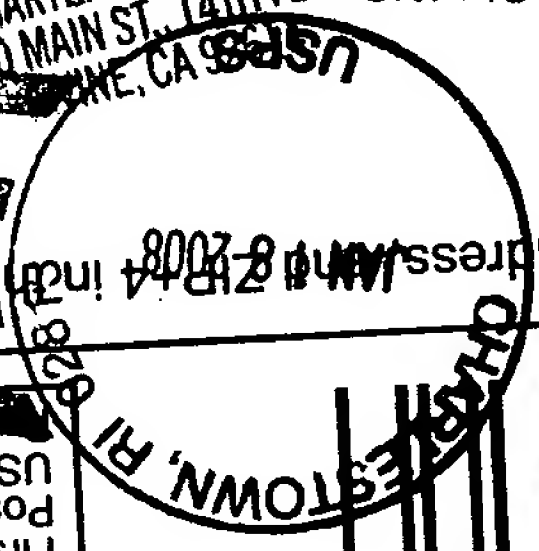
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2. Article Number (Transfer from service label) 7006 0100 0004 5806 4533
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Ted M. Cannon
949-721-2897
tcannon@kmob.com

March 3, 2008

VIA CERTIFIED MAIL
No. 7006 0100 0004 5806 4427Charles L. Jones III
4570 Old Post Road
Charlestown, RI 02813-2560Re: Patent Application for Prepayment Score
Application No. 09/942983
Our Reference: EXP.046A

Dear Mr. Jones:

As you know, a patent application for your invention entitled METHOD AND APPARATUS FOR DETERMINING LOAN PREPAYMENT SCORE was filed on May 15, 1998 and assigned Application No. 09/078,867, which is now issued Patent No. 6,185,543. You, Yuri Galperin, Vladimir Fishman and William A. Eginton were listed as inventors on this application. A later related application was filed on August 30, 2001 and assigned Serial No. 09/942,983, but did not include you as an inventor. It is our understanding that you were erroneously left off this application through no deceptive intent on your part.

Therefore, we are filing a Petition with the U.S. Patent Office to correct inventorship on the related application. In order to correct inventorship we need you to sign a declaration acknowledging that you and the other three inventors are the inventors of this application. In addition, you need to sign a Statement indicating that you were erroneously left off this application through no deceptive intent on your part ("Statement").

I have enclosed a copy of the application as filed (including the specification, drawings and claims), the Statement and an Assignment of the invention to Marketswitch. Please review the application to confirm that you should be added as an inventor.

I have previously sent you other copies of the same documents that I have enclosed in this letter, but I have not received a response. Please respond to this letter as soon as possible so that we can promptly correct inventorship in the application.

Charles L. Jones III

March 3, 2008

Page -2-

After your review, please sign and promptly return to me the Declaration, the Statement, and the Assignment in the pre-addressed envelope.

If you have any questions or if you would like to discuss this matter, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Ted M. Cannon". The signature is fluid and cursive, with a long horizontal stroke at the end.

Ted M. Cannon

Enclosures

4961618

SPECIFICATION

TITLE: METHOD AND APPARATUS FOR DETERMINING A
PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT

RELATED APPLICATIONS

[01] This application claims the benefit of Provisional Application Serial No. 60/228,954, filed August 31, 2000, which is incorporated herein in its entirety.

FIELD OF THE INVENTION

[02] This invention relates generally to receiving applications for and processing of lending transactions. More specifically this invention provides a method and apparatus to assess the prepayment propensity of a borrower in the form of a prepayment "score" to enable assessment of (i) the value of mortgages, second mortgages, home equity loans or other debt instruments for investors, (ii) the value of credit card accounts and balance transfers, (iii) the value of term loans and leases, (iv) the behavior of brokers with respect to churning, (v) the valuation of existing portfolios, (vi) the risk management of institutions that hold debt instruments, and (vii) the pricing of mortgage portfolio servicing contracts.

BACKGROUND OF THE INVENTION

[03] By way of an introductory example, consider the most common of debt instruments, the consumer mortgage. The value of a mortgage depends, in large part, on the duration of the mortgage. At the inception of the mortgage there are broker

fees and various other settlement costs that are charged to the lender. When a mortgage extends for the term of many years, there is an opportunity for the lender to recoup costs of putting a mortgage in place for a given consumer and to make profit on that mortgage. This is particularly important for all business organizations that lend money, but it is particularly important for those mortgage financing organizations which have stockholders and other investors.

[04] When a mortgage loan is paid off early due to refinancing, depending upon how early in the term, the mortgage loan is paid off, there is the possibility that the lending institution can actually take a loss on the particular mortgage. The rate of prepayment depends on a number of objective factors. For example, during times of decreasing mortgage rates, on average, more consumers refinance their home loans than would otherwise occur, in order to obtain a lower monthly payment. However, for a given macroeconomic environment and other measurable, objective factors, each consumer evidences an individual propensity to prepay a loan. This prepayment propensity reflects the consumer's demographic and other objective attributes. A system that can assess such individual prepayment behavior by a consumer in advance of the loan will lead to more profitable loans being made, and hence the enhanced availability of funds for loans to more consumer-borrowers. The present invention therefore may be applied, without limitation, to a) the pricing of mortgages and other debt instruments, b) the valuation of existing portfolios of debt instruments, and c) the risk management of institutions that hold debt instruments.

[05] Additionally, the present invention is not limited to the type of debt instrument or lending transaction to which the prepayment score is useful. The invention includes,

but is not limited to, mortgages (consumer and commercial), second mortgages, refinanced mortgages, consumer loans, commercial loans, asset-backed loans, consumer leases, commercial leases, credit card accounts, credit card balance transfers, debt consolidation loans (term notes, etc.), mortgage-backed securities (i.e., mortgage pass through, CMO's, mortgage-backed bonds, principal-only, interest-only, etc.), and any servicing contract for these lending transactions that performs financially based on the quality (i.e., duration) of the cash flow.

[06] A further element of the present invention is the monitoring and scoring of brokers for these lending transactions. Mortgage brokers deal with both consumer-borrowers and lenders-clients. In order to generate brokerage fees, it is possible for a broker to encourage its consumer-borrowers to refinance their mortgages frequently and prematurely. When this occurs, the mortgage broker generates a fee for the broker, however, early prepayment of the prior mortgage instrument can result in a loss for the lender. Thus the present invention also has the capability to score mortgage broker prepayment behavior.

[07] The behavior of a broker is sometimes not all heinous. Sometimes a consumer, who is particularly attuned to the rise and fall of interest rates, will simply be the one who changes mortgage instruments more frequently than the average consumer. The broker who is scored based upon the prepayment behavior of the consumers that the broker brings to lenders, would like to know the pre-payment propensity for the given consumer. This would be useful so that the mortgage broker can optimize the broker's relationship with its lender-clients by only bringing consumer-borrowers who have a low prepayment propensity.

[08] Therefore, lenders and brokers badly need the ability to better measure prepayment behavior in advance of incurring marketing or underwriting charges; these expenses are too great to absorb blindly on behalf of consumers with poor prepayment propensities. Indeed, a beneficial use of the invention would be in managing the initial marketing effort itself. For example, only those customers who can be shown to score favorably for prepayment behavior might receive a solicitation for a mortgage product A. Consumers who are revealed to represent a substantial prepayment risk may be offered a more suitable mortgage product B, reflecting the increased risk. In this way, enhanced customers segmentation and product design initiatives converge to benefit consumers and their sources of debt financing, to the benefit of each.

[09] To understand the potential impact of national prepayment scoring standard, as manifested in the present invention, one need look no farther than the existing default risk scoring standard, owned and distributed by Fair, Isaac and Company, Inc. (Fair Isaac) for over 30 years. By establishing a standard methodology for scoring borrower default risk, and broadly disseminating it, Fair Isaac dramatically enhanced mortgage lender insight into expected loan dynamics. In finance, enhanced insight is synonymous with enhanced information. Enhanced information implies reduced risk for the lender. Finally, reduced lender risk profiles produce lower costs of capital. In other words, because Fair Isaac standardized successfully a fungible measurement of default risk, more money is available for consumers to borrow, at better and cheaper interest rates. The market is more efficient than before and everyone benefits.

[10] To further qualifying the timeliness of the invention, please refer to exhibit 1, "Green Tree chief returns \$23 million..." The Wall Street Journal, March, 1998. This story highlights the industry wide uncertainty surrounding prepayment speeds in consumer debt portfolios. One industry leading company, Green Tree Financial, "has been hit hard the past year by escalating loan losses in the painful recognition that its accounting has been too aggressive. Also, an unexpected wave of loan prepayments hit the industry, as borrowers sought lower interest rates, indicating working-class consumers were not as unsophisticated as lenders had believed." Stated plainly, Green Tree overstated prior year earnings significantly, exercising its option under GAAP accounting to roll forward and capture in advance projected lending profits, even though those very profits were merely estimated based in part on arbitrary prepayment assumptions. In large measure because Green Tree badly miscalculated these prepayments speed assumptions, in 1997 the company was forced to charge off \$390 million of 1996 reported profit. In 1998 the company was sold off to Conseco.

[11] Earlier disclosures in the area of prepayment scoring in a lending context are limited or nonexistent. United States Patent No. 5,696,907, entitled "System and Method for Performing Risk and Credit Analysis of Financial Service Applications," issued to Tom. The Tom patent discloses using a neural network to mimic a loan officer's underwriting decision making. The method of the Tom patent is based on a non-iterative regression process that produces an approval criterion that is useful in preparing new or modified underwriting guidelines to increase profitability and minimize losses for a future portfolio of loans. A prepayment observation is used in the neural net as a negative flag, but no prepayment scoring system is utilized in the

Tom patent.

- [12] In view of the prior art, there is a clear need for measuring and predicting a consumer's prepayment propensity, as well as a clear and strong need for a method and apparatus to produce such a measuring and predictive parameter.

BRIEF SUMMARY OF THE INVENTION

- [13] The system and method of the present invention generally works in the following manner: the service bureau or broker will electronically capture individual loan applications from consumers. Those loan applications will be sent to lenders for evaluation. The lender, using the present invention submits the loan application for review and analysis. The loan application will be reviewed by the present invention according to a sophisticated economic and customer behavior model, which will score the prepayment behavior of candidate borrowers. The score for these borrowers, which is an index of their prepayment propensity, will be electronically returned to the lender. The lender will in turn use the prepayment score and calibrate an appropriate mortgage price including the setting of interest rates, fees, broker commissions, and potentially consumer rewards. Using this consumer scoring technique, a lending institution can seek to contact or contract with those consumers who display a low propensity to prepay.

- [14] The advanced scoring of customer prepayment propensities materially improves the lender's to risk profile as regards new lending customers. This novel insight adds value to the marketing, underwriting, lending, administrative process for first and second mortgages, credit card balance transfers, and asset-backed term loans such as

automobile loans. By assisting lenders in their efforts to segment customers according to this crucial behavior metric, waste and excess costs are driven from the lending economy. More money is thus available, more cheaply, for more people.

[15] To the borrower, this system offers several advantages. First, more favorable loan terms can be made to those consumers who exhibit a beneficial borrowing behavior, i.e., borrowers who are not likely to prepay their loans but instead maintain their loans for a profitable duration. Further, dealing with a stable borrower market results in a more favorable financial environment on for all lenders thereby mitigating the risk of loss and, in the normal course of all efficient markets, passing that financial advantage onto borrowers generally.

[16] Once again, the irrefutable economic relationship between financial risk-taking and expected financial reward informs the environment addressed by the present invention. If lenders reduce their risks-and by extension their costs-through enhanced prepayment scoring, ultimate borrowing costs paid by consumers will decline.

[17] For the loan originator, the system offers several advantages. The loan originator can more efficiently price the particular loan. Further the loan originator can more efficiently select brokers and intermediaries who will select the best borrowers. Further, the system and method of the present invention will lead to more efficient direct and indirect marketing investments by identifying individual consumers and groups of consumers who exhibit the most beneficial borrowing behavior, i.e., a propensity not to prepay financial obligations.

[18] Given that direct marketing costs are exploding as the conventional direct channels (e.g. mail and outbound telemarketing) become saturated, any available efficiency in the direct marketing process is highly desirable. For example, in the marketing of home equity lines of credit (i.e. second mortgages), direct-mail response rates are now, on average, running below 0.3% (i.e. below 3/10ths of one percent). Obviously, some fraction of even this small respondent sample will prove ill-suited, as regards prepayment behavior, for the debt product being marketed. Therefore, the tailoring of specific debt products to consumers of specific prepayment behavior characteristics is essential to the efficient pricing of debt instruments. Lead generation, third-party data acquisition, underwriting, yield spread calculations all directly inform debt instrument profitability, and are all beneficially affected by the present invention.

[19] Finally, in the context of sophisticated asset liability management (ALM), subtle prepayment behavior analysis provides significant benefits to its practitioners. Because ALM, as a primary objective, seeks to minimize destructive asymmetries in asset and liability cash flows, intelligent risk managers will utilize debt contracts of varying expected durations to strengthen their balance sheet. For example, a lender's risk manager may seek multiple classes of debt instrument, reflecting multiple prepayment profiles, in order to assure himself of adequate incoming cash flow to sustain his expected liability cash outflows. In the matching, therefore, of expected cash in- and out-flows, the prudent risk manager utilizes a carefully segmented portfolio of debt instruments scored by prepayment propensities (and other measures) and priced accordingly, to avert liquidity crises.

- [20] An additional, equally valuable use of the present invention is in the valuation of existing mortgage or debt instrument blocks of business. This valuation may be required by lender risk managers, auditors, regulators, or investors; it may reflect stakeholder interest in actively managing asset-liability risk, or it may be performed as part of the merger and acquisition appraisal. In all instances, the prepayment scoring system quantifies from a granular perspective upward to a pool, or block perspective, the prepayment speed characteristics of the debt instruments. As we have seen in the Green Tree case, failing to adequately price prepayment risk has enormous balance sheet implications, and typically leads one to grossly over value a portfolio or the enterprise itself.
- [21] For auditors, the system of the present invention offers a quantitative measure of prepayment risk thus reducing auditor exposure to "claw-back" write-downs. This situation occurs in the case of issuers that secure these mortgages and, under the generally applied accounting procedures (GAAP) accelerate and capture earnings based on certain prepayment assumptions. If those prepayment assumptions are incorrect, prior year financial statements are incorrect and massive charges are required to reflect lower portfolio earnings.
- [22] For banking regulators, the system of the present invention offers the ability to quantify balance sheet risk resulting from expected consumer prepayment behavior. This will allow regulators to more precisely measure and assign minimum bank capital levels.
- [23] For credit rating agencies, the ability to score according to an objective, standard

methodology prepayment risk provides enormous assistance in rating a lender's creditworthiness. Rating agencies function, effectively, as credit market bellweathers. Lending institutions are dependent on favorable credit ratings in order to float their institutional debt at advantageous rates; rating agencies, as in the case of regulators, evaluate carefully lenders' claims of capital adequacy; the capital (cash reserves) retained by lenders is directly and immediately affected by debt instrument prepayment speeds. This is because, under GAAP accounting rules, lenders are allowed to capture a substantial percentage of the future expected profits for a given contracted debt instrument, and those profits are themselves substantially dependent on the assumed life of the instrument. (In the case of subprime mortgages, for example, profits may double if the mortgage is maintained in force for four years instead of three). If those profits are overstated, they must be reversed, with resultant charges reducing lender capital (capital: paid-in cash investments plus retained profits). Therefore, rating agencies must scrutinize lender portfolio prepayment speed assumptions, because if those assumptions prove false, then the lender will suffer a reduction in capital. Any significant impairment of lender capital necessarily suggests a reduction in its credit rating. Credit rating agencies will be major beneficiaries and users of the present invention.

- [24] For investment bankers, the system of present invention establishes a standardized prepayment methodology that allows merger and acquisition advisers to be able to quantitatively measure the balance sheet risk in a target banking or mortgage company. In addition, investment bank usage of the present invention will include its application to debt instrument securitization. Securitization describes the process

by which pools of mortgage or other debt instruments are purchased by investment banks-in their capacity as underwriters-and re-sold to institutional and public investors as reconstituted securities. Typically, these securitizations benefit originators of debt, because they realize significant acceleration in realized profits; they also significantly diversify their risks by selling significant aspects of the debt instrument to asset underwriters and others. However, the typical debt instrument securitization proceeds with the originating lender retaining significant prepayment risk; if prepayment speeds accelerate beyond levels assumed in the securitization pricing process, the originating lender is held responsible. Hence the invention, by measuring the expected prepayment behavior and scoring in according to an accepted, industry standard method, will improve the securitization process and render it more efficient. Once again, this will reduce costs for all participants and free up more capital for lower-cost consumer borrowing.

[25] For investors, the method of the present invention provides a way to make investment decisions based upon quantified debt instrument prepayment behavior risk for lending institutions in which investors might want to invest, or to evaluate the relative stability of mortgage securities that are backed by individual debt instruments.

[26] These and other advantages of the present invention are described in reference to the specification that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[27] Figure 1 is an overview of the process of the present invention.

- [28] **Figure 2** is a block diagram of the present invention.
- [29] **Figure 3** is a block diagram showing the user interface module connections.
- [30] **Figure 4** is block diagram showing the interactions with the prepayment historical data.
- [31] **Figure 5** is a block diagram showing the interactions with the econometric model.
- [32] **Figure 6** is a block diagram showing the factors that are used by the user interface module.

DETAILED DESCRIPTION OF THE INVENTION

- [33] Referring to **Figure 1**, an overview of the process of the present invention is shown. The mortgage broker or lending institution first obtains a loan application from a borrower **10**. That information is electronically transmitted to the present invention, which parses the information **12** of the loan application into various categories that are relevant to the scoring of the potential loan. The loan application contents are parsed based upon the information needs of a sophisticated, mathematical model resident in the present invention. A prepayment score is then derived **14** for the particular consumer as a function of the particular loan type being requested, and in further view of the interest rate environment in which the loan is being processed (i.e. rising or falling interest rates). As previously noted this score is an indication of the prepayment propensity of a particular consumer. The prepayment score is then returned to the lender **16**. Thereafter the lender can create a customized loan product that rewards favorable prepayment behavior of the

consumer 18.

[34] Referring to **Figure 2**, an overview of the system of the present invention is shown. A loan originator **20** receives the application from a potential consumer. That application is then input to the loan originator's data delivery channels **22**. Such data delivery channels **22** are (without limitation) e-mail, fax, Internet, and generally other electronic means. Other loan originators **34** also send their respective consumer applications over their own data delivery channels **36**.

[35] The present invention anticipates delivery of loan applications **24** over the Internet **28** or other digital electronic means such as wireless communications methods as well. Electronic loan applications **40** enter the system of the present invention through a communication server **42**. The loan information concerning a given consumer is then submitted to an application parser **52**. Application parser **52** divides the information into loan information **58** and applicant information **56**. Loan information **58** is information that relates to the amount, the term, down payment, loan type, and other information important and relating to the amount of money to be loaned. Applicant information **56** is information such as name, address, Social Security number, and other demographic information concerning the applicant.

[36] Loan information **56** is fed into a prepayment model library database **66**. The prepayment model library database **66** comprises information concerning prepayment historical data **62**. The results are fed into model training server **64** which processes prepayment historical data **62** of both an individual and demographic groups which in turn provides updates to the model library database **66**.

Once loan information 58 is processed by the prepayment model library database 66 an analytical prepayment model 60, which is based upon the loan information 58 is provided to the prepayment calculation server 46. Prepayment calculation server 46 receives additional information from econometric model 48 which establishes the relationship among the wide variety of variables. Econometric model 48 generates interest rate, mortgage rate and other economic parameters that, arrayed in time series, comprise scenarios utilized by the prepayment calculations server. These scenarios are generated from the Low Discrepancy Sequence (LDS) logic, rather than using random number generation. The LDS logic affords significantly higher model accuracy with the same number of scenarios.

[37] Once a prepayment score 44 is derived by prepayment calculation server 46, prepayment score 44 is sent to the communication server 42 and is transmitted over the Internet (or other electronic channels) 28 through the data delivery channels 22 or 36 back to loan originators 20 or 34 who can then either approve, disapprove, or create customized loan product for the consumer.

[38] Prepayment score 38 is calculated based upon the following model. The specific prepayment analysis of the present invention is conceptually shown below.

[39] The following variables:

[40] $A = (a_1, a_2, \dots, a_n)$

[41] $L = (l_1, l_2, \dots, l_m)$

[42] are vectors of the applicant's data and loan parameters.

[43] $E_s(t) = (e_{1s}(t), e_{2s}(t), \dots, e_{ks}(t)); \quad s = 1, \dots, S$

[44] denotes a set of Low Discrepancy Sequence (LDS)-based scenarios of the econometric parameters, which have been generated by the RTH Linked Index Econometric Model. Thus the model is a set of stochastic differential equations that describe the dynamics and interaction of major macroeconomic indicators, each relevant to the prepayment propensity calculation.

[45] Analytical Prepayment Model \mathfrak{R} , which varies with the types of loan applied for, is trained to calculate prepayment value p_s in a given scenario based on the applicant's data (A), loan parameters (L), and econometric parameters (E):

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

[46] Total prepayment, accumulated by the time T in scenario s , can be calculated as:

$$P_s(T) = \prod_i p_s(t_i)$$

[47] Then, total prepayment at time T is given by:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

[48] Finally, the prepayment score is:

$$Score = \sum_T TP(T)$$

[49] The analytical model that produces the prepayment score may be further informed

by additional external behavioral or econometric factors, based on subsequent research, as well as the aforementioned behavioral scoring of mortgage broker behavior.

- [50] The present invention may also be represented in an alternative embodiment in the form of the credit engineering workstation (CEW). This CEW (more fully described below) comprises a user interface which allows a loan originator to conduct all of the prepayment calculations, model analysis, and pricing of the present invention using the prepayment model first noted above.
- [51] The CEW operates in either a Unix or Windows NT environment using Oracle, SQL server, Sybase, DB2, or Informix database support. The CEW also uses CORBA or, structured object models together with a JAVA/HTML browser based graphical user interface.
- [52] The subroutines of the CEW all contribute to the end goal of determining the prepayment propensity of a consumer. For example, subroutines of the present invention deal supports the generation of various interest rate scenarios, and subsequent economic scenarios model fitting processes that fit the modeled interest rates scenarios to historical and current interest rate yield curve performance as well as to other macro economic indicators.
- [53] Part of the system includes rewards pricing logic to efficiently measure and price the impact of rewards on consumer prepayment behavior. For example it would be most beneficial to a lender to reward the consumer for not prepaying the lender's loan. Such a reward could be assessed in terms of its impact on the consumer

prepayment behavior. The system therefore permits the end-user to design pro forma rewards structures and to test their impact on prospective consumer prepayment behavior.

- [54] Various user definable screens also establish default spreads, prepayment spreads, broker commission schedules, and other financial factors that influence the pricing of the product to be offered to the consumer. Various other economic scenarios are collected via the user interface and combined with various probabilities and default data as well as other lender defined criteria result in rationally priced end-user mortgage contracts.
- [55] Referring to **Figure 3**, further information concerning the CEW of the present invention shown. The system comprises user interface module **70** which is the basic graphical user interface and other software that allows an originator to provide information concerning a consumer who wishes to borrow money from lender. The user interface module allows the collection of loan attributes **76**, applicant attributes **74**, and reward program attributes **72**. In addition user interface module **70** collects or calculates spreads, broker commissions and other costs associated with the loan **78**. Loan attributes **76** and other loan related costs are fed into pricing engine **84** which, with other information, assists in creating an appropriate loan price **86**.
- [56] Loan attributes **76**, applicant attributes **74**, and reward program attributes **72** all which have an impact on the value of the loan are fed into prepayment calculation server **80**. Prepayment calculation server **80** receives input from the various prepayment model parameters and creates prepayment score **82**.

- [57] Referring to **Figure 4**, a block diagram showing the interactions which are necessary to create a prepayment model are shown. Consumer information **96** which consists of applicant attributes **74** and loan attributes **76** are fed into a prepayment model fitting **92** module. Prepayment model fitting **92** establishes various prepayment model parameters **94** based upon prepayment historical data **90**. Once the appropriate prepayment model is created by prepayment model fitting **92**, a model is returned to the prepayment calculation server for the calculation of the prepayment score of the particular consumer given the type of loan to consumer is requesting. The prepayment calculation server also benefits from input from an econometric model scenario generator.
- [58] Referring to **Figure 5**, the interactions for the econometric model are shown. Econometric model scenario generator **106** receives input from econometric model fitting module **104** and LDS scenarios **108**. Econometric model fitting module **104** receives information from econometric historical data **100** and current market environment **102** which comprises, without limitation, information concerning rising or falling interest rates and trends. The information from econometric historical data **100** concerns the demographic group to which the consumer belongs and other econometric information such as age, income, credit rating, occupation and other factors. The information from current market environment **102** concerns the direction and velocity of changes to interest rates. Econometric model scenario generator **106** processes the information and produces various scenarios based on the information.
- [59] Referring again to **Figure 3**, prepayment calculation server **80** creates prepayment score **44** for the particular consumer in question. Prepayment score **44** is based upon

the established prepayment model and the generated econometric model.

Prepayment score **44** is transmitted to the pricing engine **82** to establish the pricing of the loan product to be offered to the consumer in question.

[60] Referring to **Figure 6**, additional parameters which the user interface module uses to create the various scenarios are shown. Additional aspects of the present invention provide for creation of new products. Strategy optimizer **122** is based upon acceptance of offered products by consumers and input from and relating to other products are on the market. Strategy optimizer **122** generates marketing plans based upon individual lenders' portfolios. Such a market plan could assist the lender in offering new products to the marketplace that are more profitable for the lender. The system includes targeting optimizer **124** which provides a way to offer loan products to those consumers having the most favorable prepayment characteristics, i.e., a low propensity to prepay loans made. The system also comprises loyalty optimizer **126** which models and defines offers and other inducements to consumers to reward financially advantageous consumer behavior. Channel optimizer **128** is part of the present invention. Channel optimizer **128** analyzes the channels of delivery of financial product offerings to evaluate and determine the channel that is the most efficient way to deliver various financial products. The system also comprises database optimizer **130** which receives and organizes information in the various databases to constantly build and refined prepayment historical data **90** and econometric historical data **100**.

[61] The target platform on which the system of the present invention will run is either an Intel Pentium processor based system with typically 32 megabytes of RAM, hard

disk storage and retrieval, and communications capability using the TCP/IP protocol. Alternatively the system will also run under the UNIX operating system on a Sun Solaris platform. In both cases displays for users are anticipated as is the ability to output hard copy reports. In typical operation, a plurality of users, remote from the system site will access the system via private networks or over the Internet to send the information necessary for the present invention to make the desired calculations leading to the prepayment score. This score is then sent back to the requesting user at the remote terminal.

[62] Although described herein with respect to a mortgage loan or loan, the present invention is applicable to numerous financial instruments that have a value that depends on the particular consumer's actions over time. The value of typical debt instruments, such as, but not limited to, mortgages, second mortgages, home equity loans, car loans, school loans, term loans, leases, credit card accounts, and credit card balance transfers, depend on a continued stream of cash and are therefore affected significantly by prepayment.

[63] The value of other instruments that depend on the cash stream over time, such as open-end car leases and whole-life insurance policies, can also depend on the consumer's actions, and therefore, for purposes of this invention can be considered as a form of debt instrument. In the car lease scenario, predicting the probability of a consumer electing to purchase or return the car before the end of the lease (prepay) is important in determining the value of the lease. Even a consumer's predisposition to keeping (purchasing at residual value price, a type of prepayment) or returning the car at the end of the lease can be used to modify the lease terms to the leasing entity's

advantage.

- [64] Likewise, the likelihood of a consumer to cash out the surrender value of a whole-life insurance policy (another form of prepayment, albeit in the opposite direction, that ends the stream of cash) can significantly affect the ultimate value of the policy to the insurer.
- [65] Known database and computer-based data mining techniques can be used for analyzing: the value of financial instruments (and portfolios in which they are packaged) based on the prepayment score associated with each of them; the risk associated with portfolios containing the financial instruments; and the pricing for servicing those portfolios. Additionally, instruments can be packaged together into portfolios based, at least in part, on the prepayment scores of the applicants.
- [66] A system and method for prepayment score generation has been described. Those skilled in the art will appreciate that other variations of the present invention are possible without departing from the scope of the invention as described.

WHAT IS CLAIMED IS:

[c1] A system for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:

at least one debt instrument origination computer terminal for accepting and transmitting a debt instrument application of an individual applicant;

a computer network connected to the at least one debt instrument origination computer terminal for receiving the transmitted debt instrument application of the individual applicant;

a communication server connected to the computer network for receiving the transmitted debt instrument application of the individual applicant;

an application parser connected to the communications server for receiving the transmitted debt instrument application of the individual applicant from the communications server and parsing the information into debt instrument information and applicant information;

a prepayment model library database comprising debt instrument prepayment models connected to the application parser for receiving the debt instrument information and fitting the debt instrument information into the debt instrument prepayment models and for transmitting debt instrument prepayment models that match the debt instrument information; and

a prepayment calculation server comprising a prepayment score generation model connected to the prepayment model library database for receiving the debt instrument

prepayment models and calculating a prepayment score for the debt instrument application of the individual applicant based upon the debt instrument prepayment model and the prepayment score generation model, the prepayment calculation server being further adapted to transmit the prepayment score to at least one debt instrument origination computer terminal via the communications server and the computer network;

where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment; and

wherein the at least one debt instrument origination computer terminal is adapted to use the prepayment score to adjust terms of the debt instrument of the individual applicant.

[c2] The system for determining a prepayment score of claim [c1], where the prepayment model library database further comprises:

a model training server for creating the debt instrument prepayment models for the prepayment model library database; and

prepayment historical data storage means connected to the model training server, the prepayment historical data further comprises prepayment statistics regarding debt instruments of various types.

[c3] The system for determining a prepayment score of claim [c1], where the prepayment calculation server further comprises an econometric model that

generates Low Discrepancy Sequence (LDS)-based scenarios of econometric parameters for input to the prepayment calculation server.

- [c4] The system for determining a prepayment score of claim [c1], further comprising means adapted to calculate a total prepayment at time T from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

- [c5] The system for determining a prepayment score of claim [c4], further comprising means adapted to calculate the total prepayment, accumulated by time, in scenario s from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

- [c6] The system for determining a prepayment score of claim [c5], further comprising means adapted to calculate the prepayment value in a given scenario from the formula:

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \mathfrak{R} is an analytical prepayment model.

- [c7] The system for determining a prepayment score of claim [c1], where the applicant is either an individual consumer or an individual household.
- [c8] The system for determining a prepayment score of claim [c1], further comprising computer-based means for using data associated with the prepayment score of the applicant and terms of the debt instrument to determine a calculation selected from the group consisting of: a value of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.
- [c9] A method for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:
- collecting debt instrument and applicant information at a debt instrument originator;
 - transmitting the debt instrument and applicant information over a network;
 - receiving the debt instrument and applicant information at a service bureau;
 - the service bureau calculating a prepayment score the individual applicant, where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment;

the service bureau returning the prepayment score over the network to the debt

instrument originator; and

the debt instrument originator using the prepayment score to customize a debt instrument product for the individual applicant.

- [c10] The method for determining a prepayment score of claim [c9], where calculating a prepayment score for the applicant comprises parsing the information into debt instrument information and applicant information.
- [c11] The method for determining a prepayment score of claim [c10], further comprising providing the applicant information to a prepayment model library database and the debt instrument information to a prepayment calculation server.
- [c12] The method for determining a prepayment score of claim [c11], further comprising the prepayment model library determining the prepayment model that best applies to the debt instrument information and providing that prepayment model to the prepayment calculation server.
- [c13] The method for determining a prepayment score of claim [c12], further comprising the prepayment calculation server receiving a prepayment model and an econometric model, where the prepayment calculation server further calculates a prepayment score for the applicant.
- [c14] The method for determining a prepayment score of claim [c13], where the total prepayment at time T is calculated from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

[c15] The method for determining a prepayment score of claim [c14], where the total prepayment, accumulated by time, in scenario s is calculated from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

[c16] The method for determining a prepayment score of claim [c15], where the prepayment value in a given scenario is calculated from the formula:

$$p_s(t) = \Re(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \Re is an analytical prepayment model.

[c17] The method for determining a prepayment score of claim [c9], where the applicant is defined as an individual consumer or an individual household.

[c18] The method for determining a prepayment score of claim [c9], further comprising rating a broker based on prepayment scores of applicants that are clients of said broker.

[c19] The method for determining a prepayment score of claim [c9], further comprising using the prepayment score of the applicant and terms of the debt instrument to assist in determining a calculation selected from the group consisting of: a value

of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c20] The method for determining a prepayment score of claim [c9], further comprising packaging said debt instrument into a portfolio based, at least in part, on the prepayment score of the applicant.

Abstract of the Disclosure

A method and apparatus is disclosed for determining the prepayment propensity of individual borrowers. Early payment of debt instruments, such as loans and leases, can lead to losses being suffered by lenders. The present invention analyzes the demographics associated with a particular borrower to determine both the individual and group based prepayment propensity. The history of the borrower, the history of the borrower's demographic group, interest rate trends and other factors are then used to calculate a prepayment score that can be used by the lender to determine the propensity of a given borrower to prepay the instrument in question. The score of the individual borrower can be used to estimate the profitability of a debt instrument and allow the lender to make appropriate adjustments prior to issuing the instrument. The individual prepayment scores of a lender's or broker's clients can also be used to rate the lender or broker.

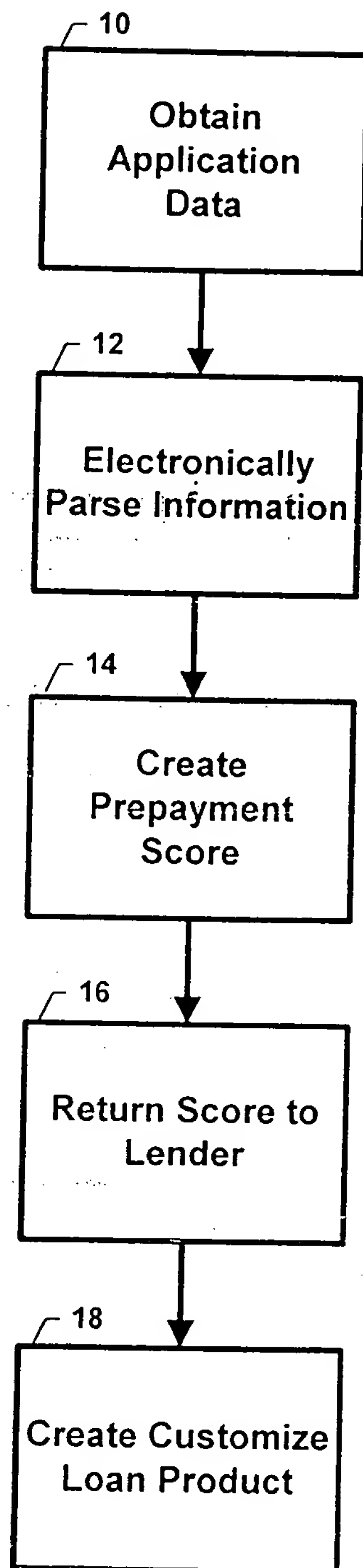


FIGURE 1

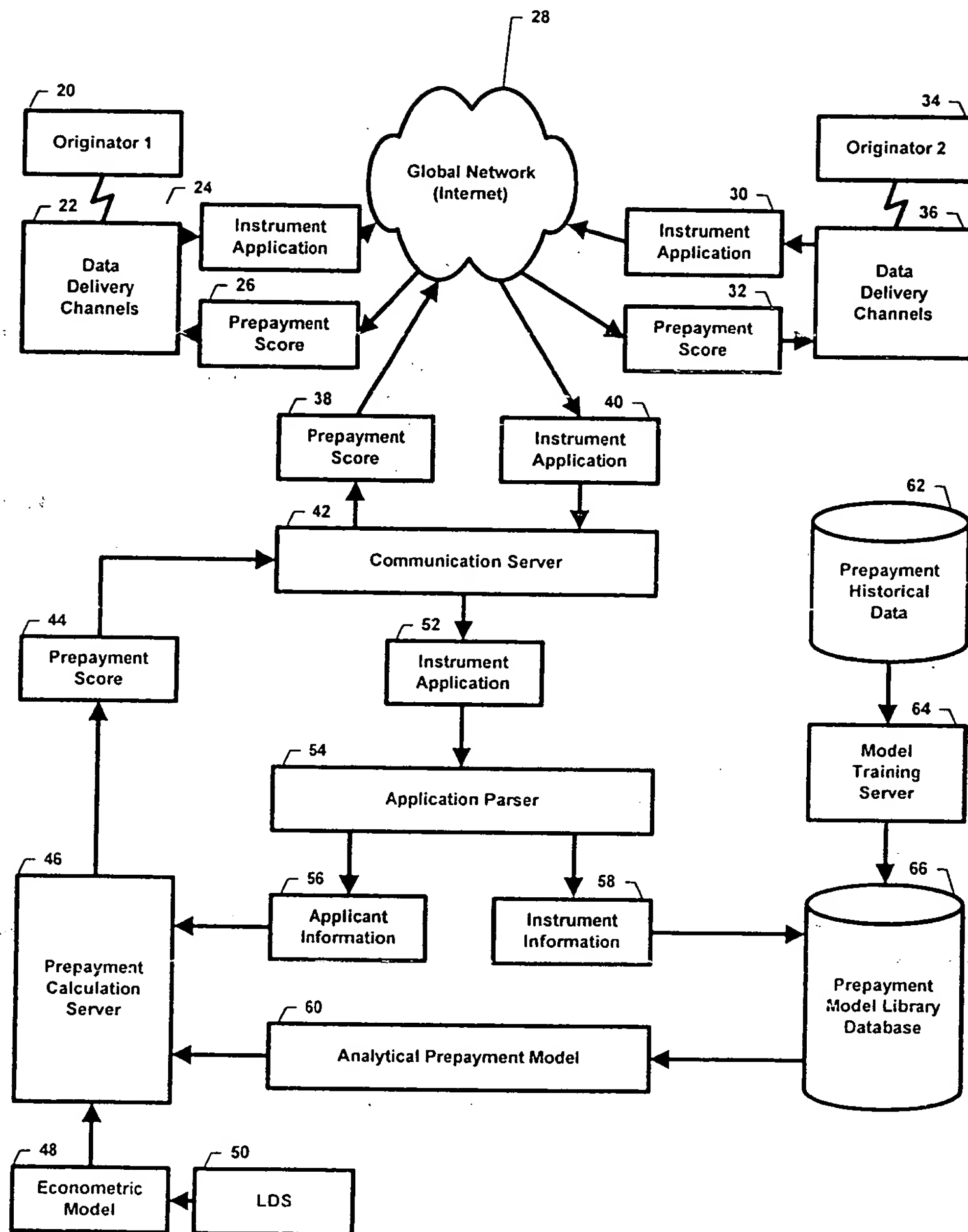


FIGURE 2

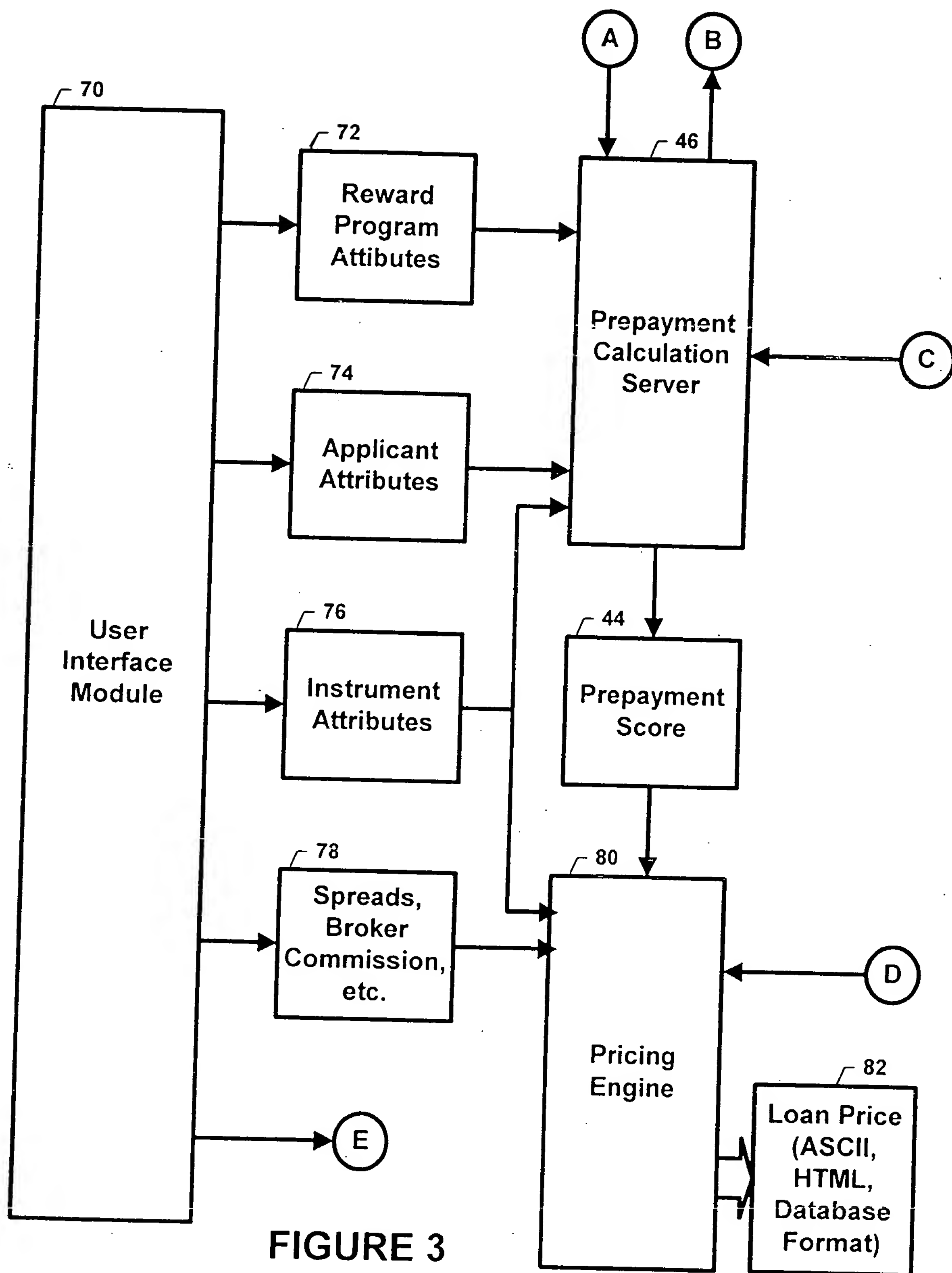


FIGURE 3

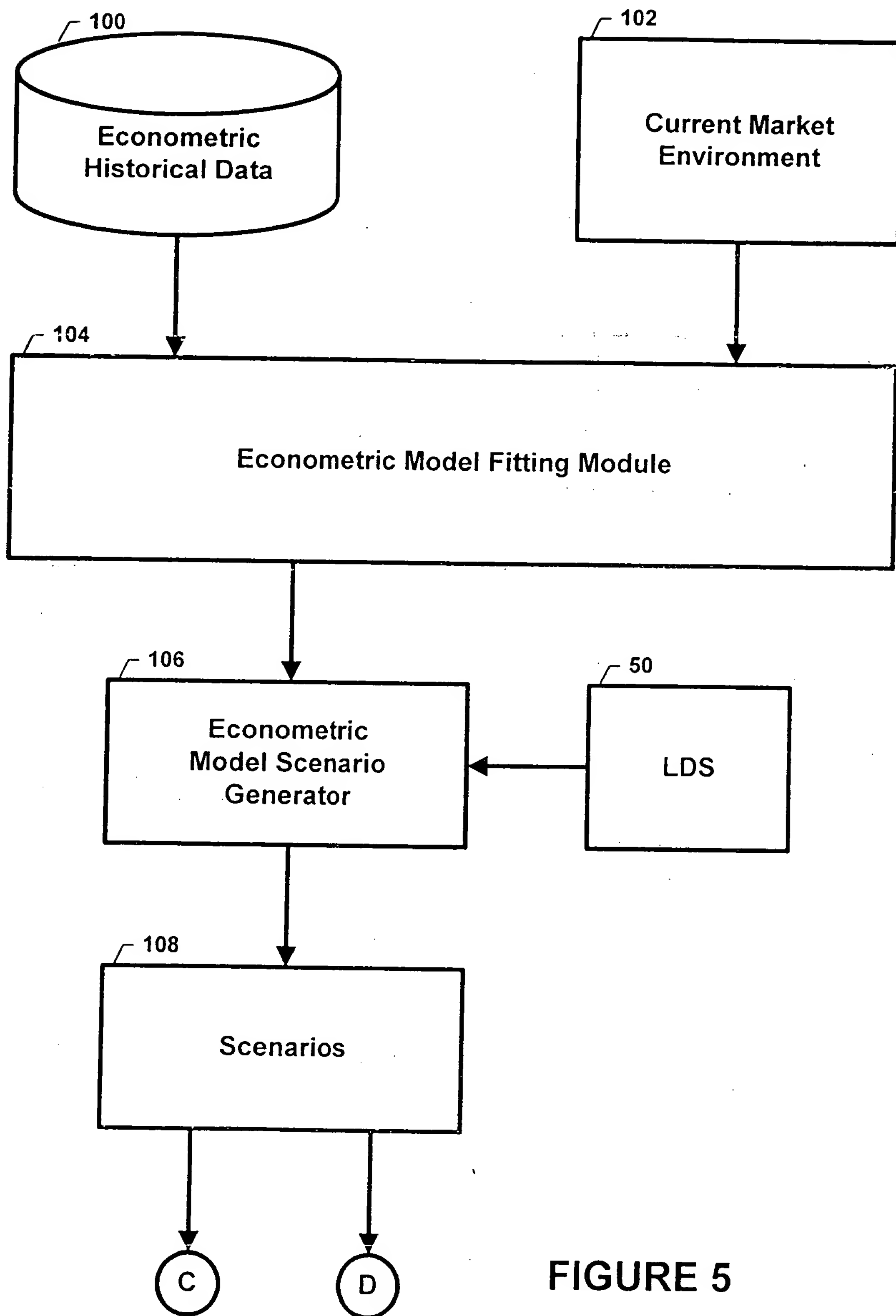


FIGURE 5

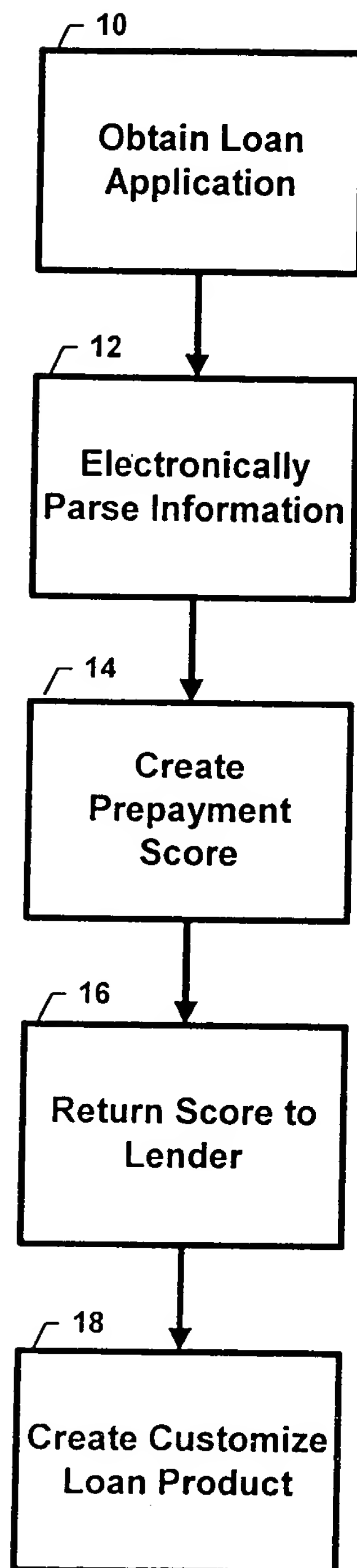


FIGURE 1

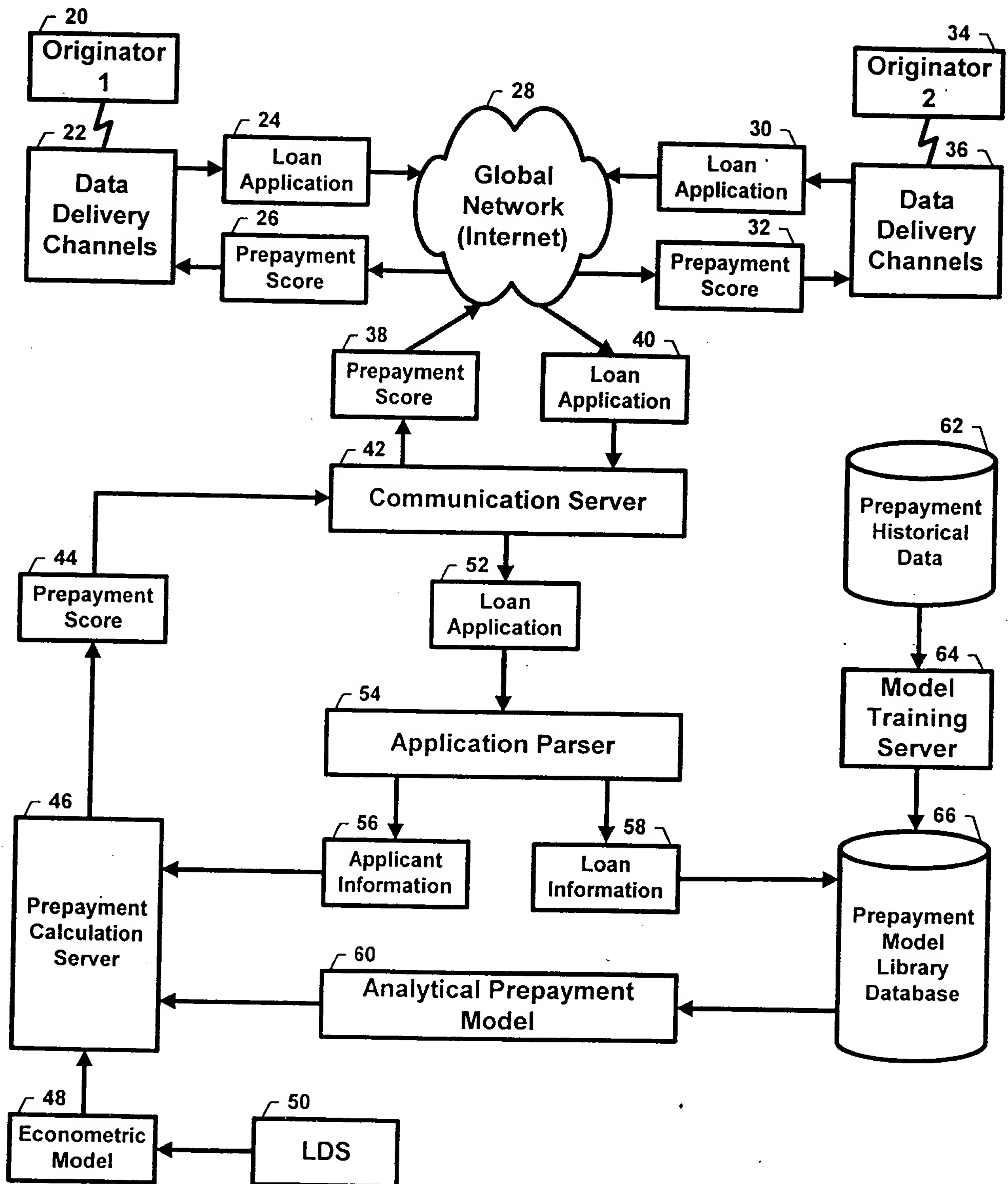


FIGURE 2

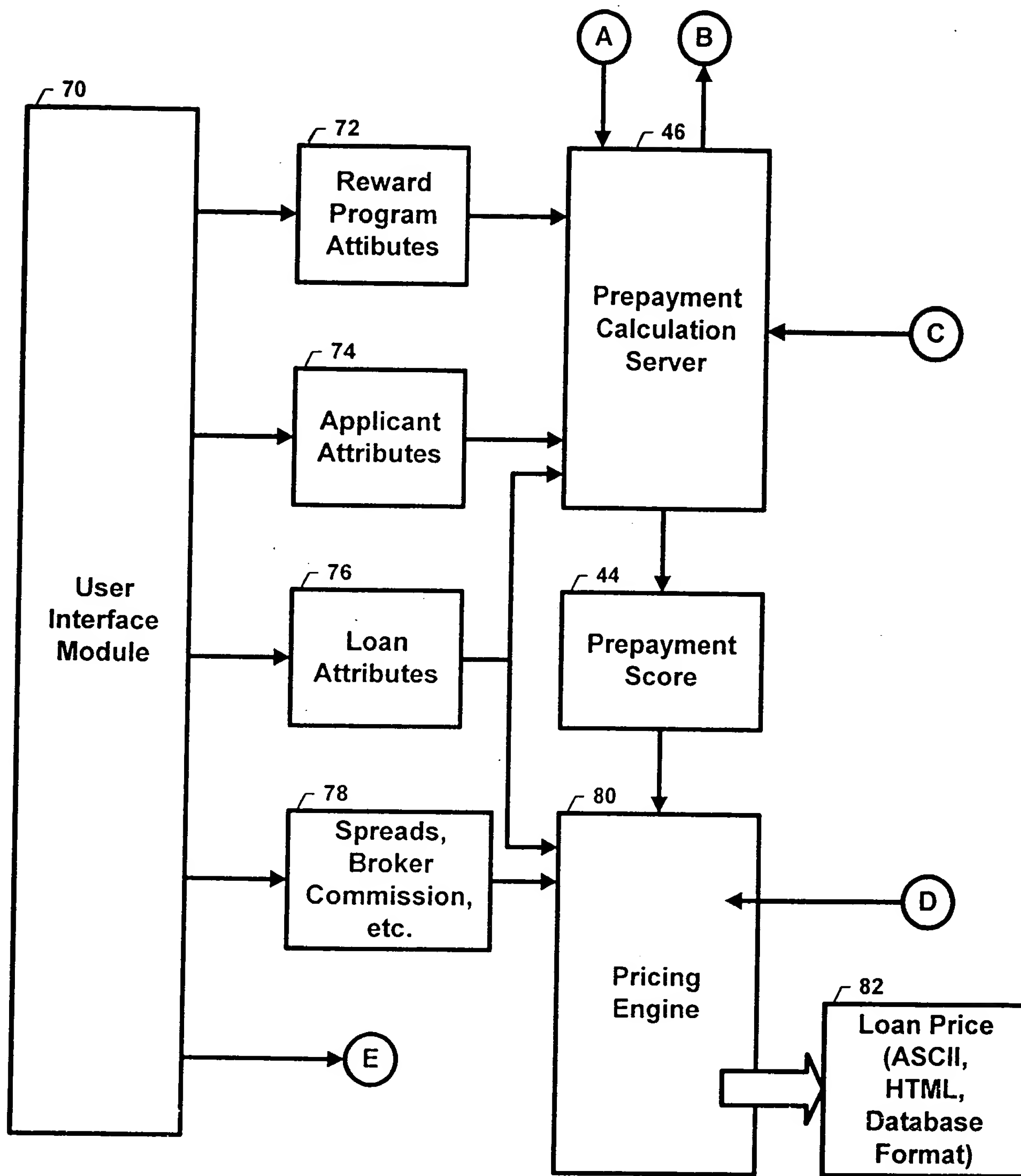


FIGURE 3

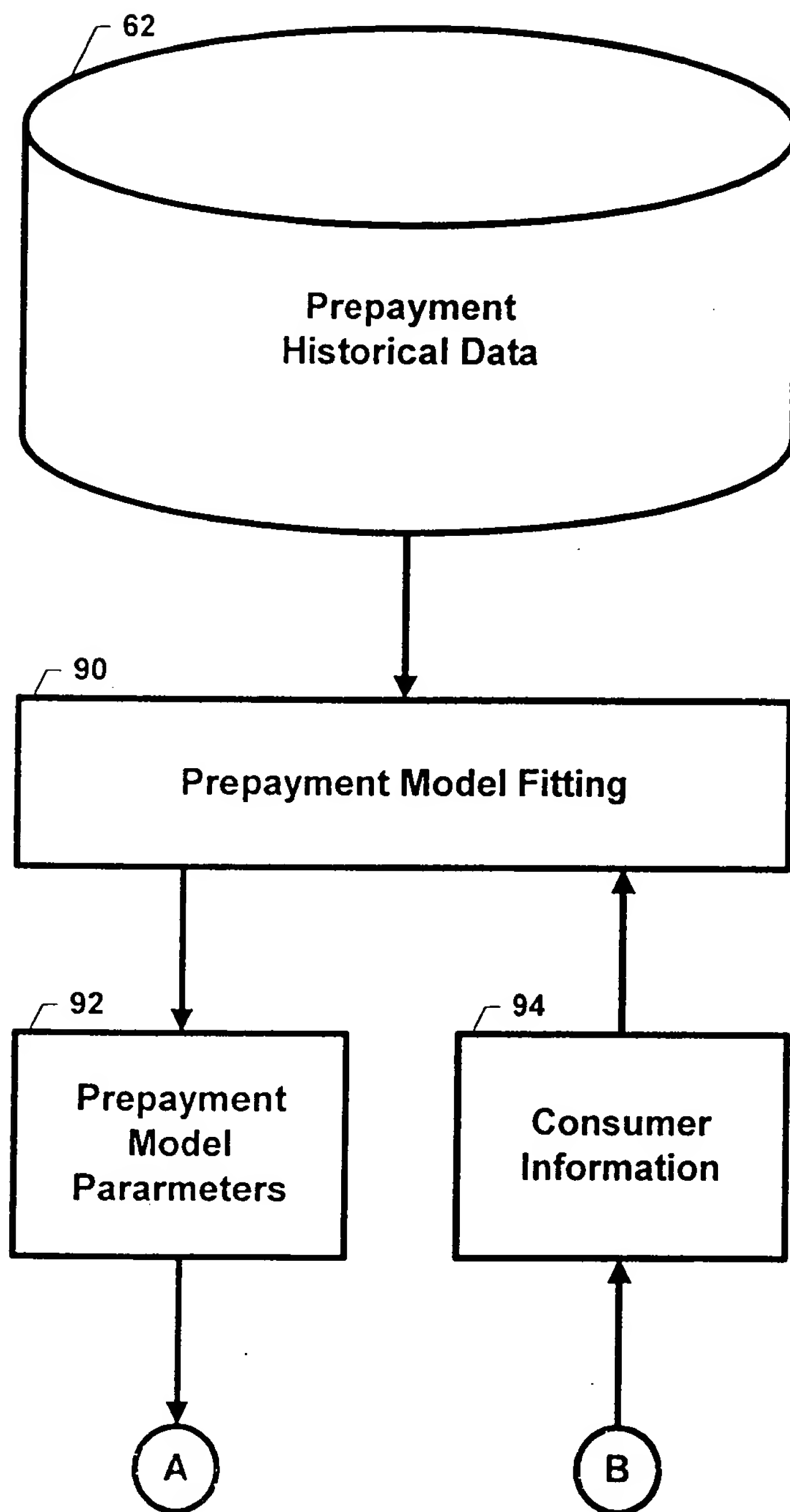


FIGURE 4

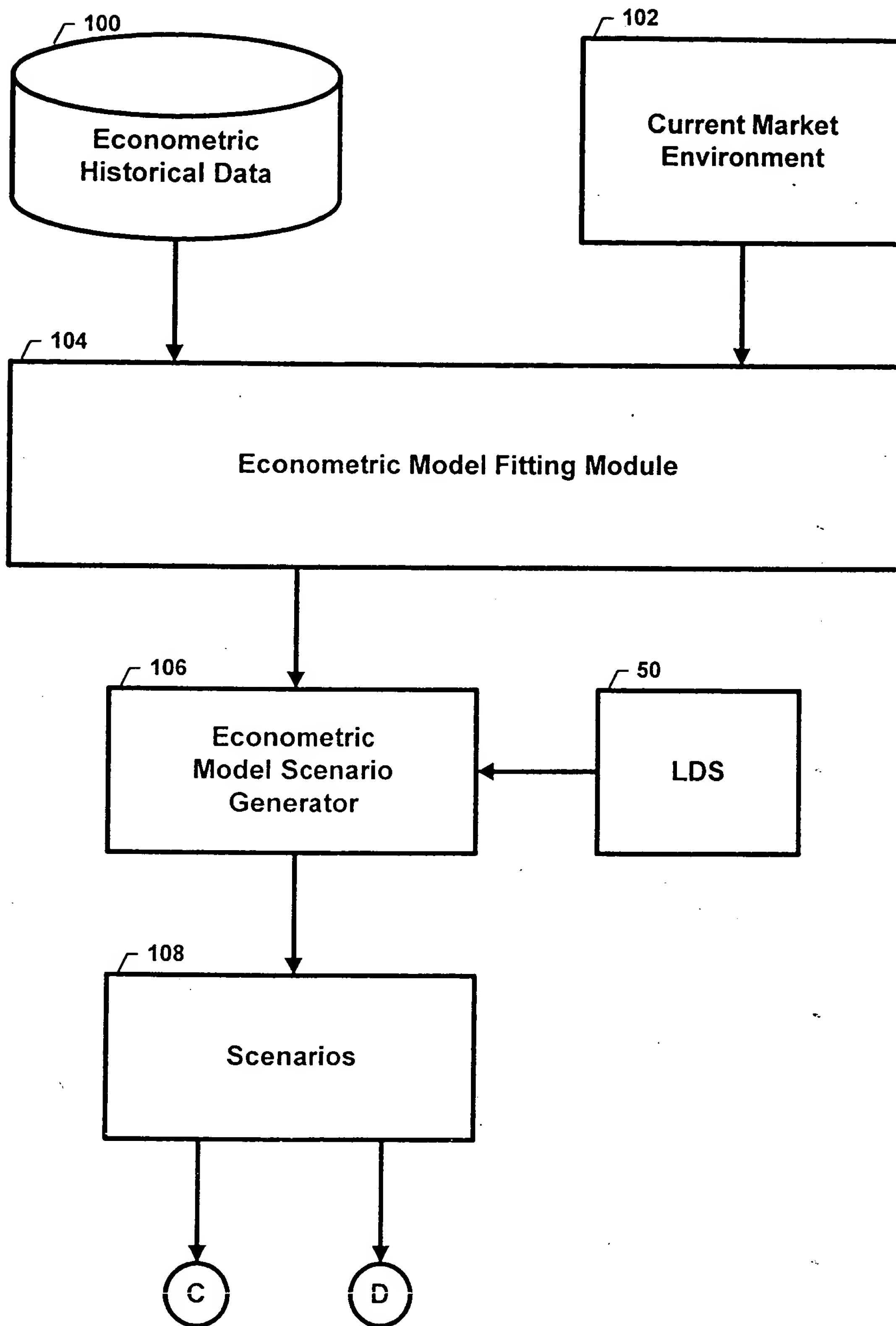


FIGURE 5

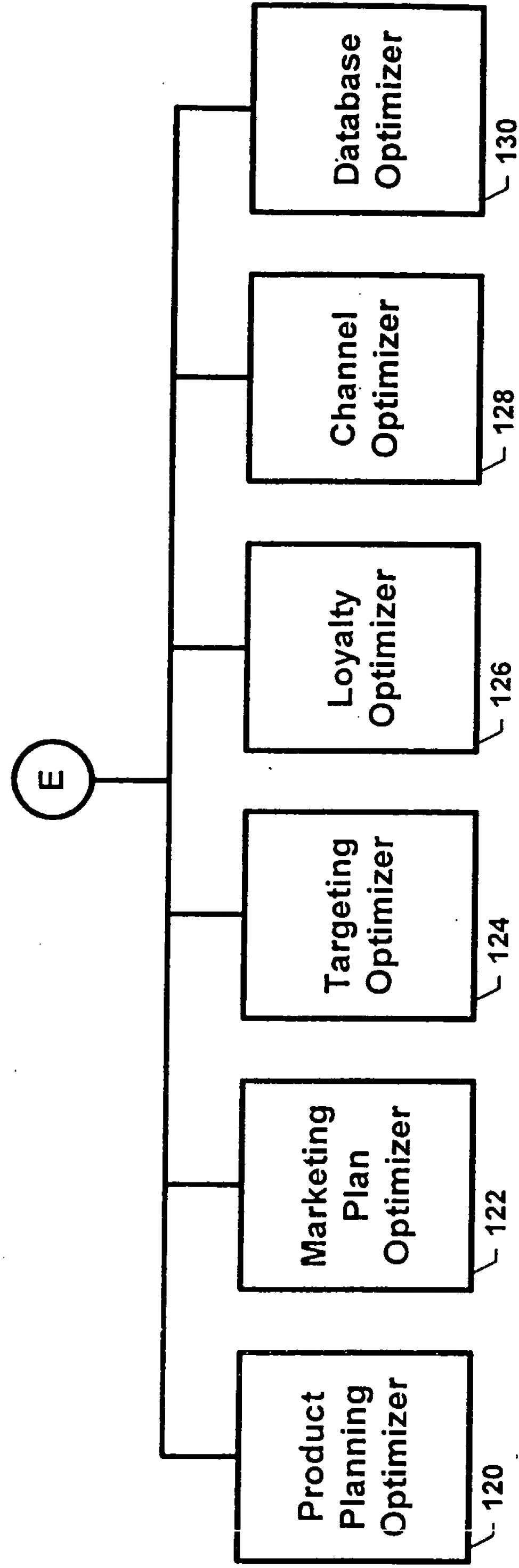


FIGURE 6

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Yuri Galperin, et al.
Appl. No.	: 09/942,983
PCT Filing Date	: August 30, 2001
For	: METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT
Examiner	: Siegfried E. Chencinski
Group Art Unit	: 3692

STATEMENT OF CHARLES L. JONES III UNDER 37 C.F.R. § 1.48(a)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Charles L. Jones III, do declare as follows:

1. I am a citizen of the United States and reside at _____.
2. The above-referenced patent application was filed on August 30, 2001 listing Yuri Galperin, Vladimir Fishman and William A. Eginton as the joint inventors.
3. I believe that I, Charles L. Jones III, should also be named as an inventor in the above-referenced application.
4. The inventorship error occurred without deceptive intent on my part.

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or document, or any registration resulting therefrom.

Dated: _____

Charles L. Jones III

ASSIGNMENT

WHEREAS, I, Charles L. Jones III, residing at _____, am a joint inventor, along with Yuri Galperin, Vladimir Fishman, and William A. Eginton, of certain new and useful improvements in a METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT for which we have filed an application for Letters Patent in the United States, Application No. 09/942,983 Filed on August 30, 2001;

AND WHEREAS, MarketSwitch Corporation (hereinafter "ASSIGNEE"), a Delaware corporation, with its principal place of business at 2350 Corporate Park Drive, Suite 400, Herndon, VA 20171, desires to acquire the entire right, title, and interest in and to said improvements and said Application:

NOW, THEREFORE, in consideration of the sum of One Dollar (\$1.00) to me in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, I, said inventor, do hereby acknowledge that I have sold, assigned, transferred and set over, and by these presents do hereby sell, assign, transfer and set over, unto said ASSIGNEE, its successors, legal representatives and assigns, the entire right, title, and interest throughout the world in, to and under said improvements, and said application including all provisional applications relating thereto (including but not limited to U.S. Provisional Application No(s). 60/228,954, filed August 31, 2000 (respectively if plural applications)), and all divisions, renewals and continuations thereof, and all Letters Patent of the United States which may be granted thereon and all reissues and extensions thereof, and all rights of priority under International Conventions and applications for Letters Patent which may hereafter be filed for said improvements in any country or countries foreign to the United States, and all Letters Patent which may be granted for said improvements in any country or countries foreign to the United States and all extensions, renewals and reissues thereof; and I hereby authorize and request the Commissioner of Patents of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents on applications as aforesaid, to issue all Letters Patent for said improvements to said ASSIGNEE, its successors, legal representatives and assigns, in accordance with the terms of this instrument.

AND I DO HEREBY sell, assign, transfer, and convey to ASSIGNEE, its successors, legal representatives, and assigns all claims for damages and all remedies arising out of any violation of the rights assigned hereby that may have accrued prior to the date of assignment to ASSIGNEE, or may accrue hereafter, including, but not limited to, the right to sue for, collect, and retain damages for past infringements of said Letters Patent before or after issuance.

AND I HEREBY covenant and agree that I will communicate to said ASSIGNEE, its successors, legal representatives and assigns, any facts known to us respecting said improvements, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuing and reissue applications, make all rightful oaths and generally do everything possible to aid said ASSIGNEE, its successors, legal representatives and assigns, to obtain and enforce proper patent protection for said improvements in all countries.

IN TESTIMONY WHEREOF, I hereunto set my hand and seal this _____ day of _____, 20__.

Charles L. Jones III

STATE OF }
 }
COUNTY OF } ss.

On _____, before me, _____, notary public, personally appeared **Charles L. Jones III** personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged to me that he executed the same in his authorized capacity(ies), and that by his signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

[SEAL]

Notary Signature

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Second inventor: **Vladimir Fishman**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Third inventor: **William A. Eginton**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Fourth inventor: **Charles L. Jones III**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: _____

Mailing Address: same as above

Send Correspondence To:
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IRVINE, CA 92614

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EXP-046A

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Charles L. Jones III
4570 Old Post Rd.
Charlestown, RI
02813-2560

2. Article Number

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7006 0100 0004 5806 4427

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MAR 6 2008

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April 8, 2008

VIA CERTIFIED MAIL
No. 7006 0100 0004 5806 4397

Charles L. Jones III
4570 Old Post Road
Charlestown, RI 02813-2560

Re: Patent Application for Prepayment Score
Application No. 09/942983
Our Reference: EXP.046A

Dear Mr. Jones:

As you know, a patent application for your invention entitled METHOD AND APPARATUS FOR DETERMINING LOAN PREPAYMENT SCORE was filed on May 15, 1998 and assigned Application No. 09/078,867, which is now issued Patent No. 6,185,543. You, Yuri Galperin, Vladimir Fishman and William A. Eginton were listed as inventors on this application. A later related application was filed on August 30, 2001 and assigned Serial No. 09/942,983, but did not include you as an inventor. It is our understanding that you were erroneously left off this application through no deceptive intent on your part.

Therefore, we are filing a Petition with the U.S. Patent Office to correct inventorship on the related application. In order to correct inventorship we need you to sign a declaration acknowledging that you and the other three inventors are the inventors of this application. In addition, you need to sign a Statement indicating that you were erroneously left off this application through no deceptive intent on your part ("Statement").

I have enclosed a copy of the application as filed (including the specification, drawings and claims), the Statement and an Assignment of the invention to Marketswitch. Please review the application to confirm that you should be added as an inventor.

Charles L. Jones III

April 8, 2008

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I have previously sent you other copies of the same documents that I have enclosed in this letter, but I have not received a response. Please respond to this letter as soon as possible so that we can promptly correct inventorship in the application.

After your review, please sign and promptly return to me the Declaration, the Statement, and the Assignment in the pre-addressed envelope.

If you have any questions or if you would like to discuss this matter, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Ted M. Cannon", with a stylized, cursive script.

Ted M. Cannon

Enclosures

4961618

SPECIFICATION

TITLE: METHOD AND APPARATUS FOR DETERMINING A
PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT

RELATED APPLICATIONS

[01] This application claims the benefit of Provisional Application Serial No. 60/228,954, filed August 31, 2000, which is incorporated herein in its entirety.

FIELD OF THE INVENTION

[02] This invention relates generally to receiving applications for and processing of lending transactions. More specifically this invention provides a method and apparatus to assess the prepayment propensity of a borrower in the form of a prepayment "score" to enable assessment of (i) the value of mortgages, second mortgages, home equity loans or other debt instruments for investors, (ii) the value of credit card accounts and balance transfers, (iii) the value of term loans and leases, (iv) the behavior of brokers with respect to churning, (v) the valuation of existing portfolios, (vi) the risk management of institutions that hold debt instruments, and (vii) the pricing of mortgage portfolio servicing contracts.

BACKGROUND OF THE INVENTION

[03] By way of an introductory example, consider the most common of debt instruments, the consumer mortgage. The value of a mortgage depends, in large part, on the duration of the mortgage. At the inception of the mortgage there are broker

fees and various other settlement costs that are charged to the lender. When a mortgage extends for the term of many years, there is an opportunity for the lender to recoup costs of putting a mortgage in place for a given consumer and to make profit on that mortgage. This is particularly important for all business organizations that lend money, but it is particularly important for those mortgage financing organizations which have stockholders and other investors.

[04] When a mortgage loan is paid off early due to refinancing, depending upon how early in the term, the mortgage loan is paid off, there is the possibility that the lending institution can actually take a loss on the particular mortgage. The rate of prepayment depends on a number of objective factors. For example, during times of decreasing mortgage rates, on average, more consumers refinance their home loans than would otherwise occur, in order to obtain a lower monthly payment. However, for a given macroeconomic environment and other measurable, objective factors, each consumer evidences an individual propensity to prepay a loan. This prepayment propensity reflects the consumer's demographic and other objective attributes. A system that can assess such individual prepayment behavior by a consumer in advance of the loan will lead to more profitable loans being made, and hence the enhanced availability of funds for loans to more consumer-borrowers. The present invention therefore may be applied, without limitation, to a) the pricing of mortgages and other debt instruments, b) the valuation of existing portfolios of debt instruments, and c) the risk management of institutions that hold debt instruments.

[05] Additionally, the present invention is not limited to the type of debt instrument or lending transaction to which the prepayment score is useful. The invention includes,

but is not limited to, mortgages (consumer and commercial), second mortgages, refinanced mortgages, consumer loans, commercial loans, asset-backed loans, consumer leases, commercial leases, credit card accounts, credit card balance transfers, debt consolidation loans (term notes, etc.), mortgage-backed securities (i.e., mortgage pass through, CMO's, mortgage-backed bonds, principal-only, interest-only, etc.), and any servicing contract for these lending transactions that performs financially based on the quality (i.e., duration) of the cash flow.

[06] A further element of the present invention is the monitoring and scoring of brokers for these lending transactions. Mortgage brokers deal with both consumer-borrowers and lenders-clients. In order to generate brokerage fees, it is possible for a broker to encourage its consumer-borrowers to refinance their mortgages frequently and prematurely. When this occurs, the mortgage broker generates a fee for the broker, however, early prepayment of the prior mortgage instrument can result in a loss for the lender. Thus the present invention also has the capability to score mortgage broker prepayment behavior.

[07] The behavior of a broker is sometimes not all heinous. Sometimes a consumer, who is particularly attuned to the rise and fall of interest rates, will simply be the one who changes mortgage instruments more frequently than the average consumer. The broker who is scored based upon the prepayment behavior of the consumers that the broker brings to lenders, would like to know the pre-payment propensity for the given consumer. This would be useful so that the mortgage broker can optimize the broker's relationship with its lender-clients by only bringing consumer-borrowers who have a low prepayment propensity.

[08] Therefore, lenders and brokers badly need the ability to better measure prepayment behavior in advance of incurring marketing or underwriting charges; these expenses are too great to absorb blindly on behalf of consumers with poor prepayment propensities. Indeed, a beneficial use of the invention would be in managing the initial marketing effort itself. For example, only those customers who can be shown to score favorably for prepayment behavior might receive a solicitation for a mortgage product A. Consumers who are revealed to represent a substantial prepayment risk may be offered a more suitable mortgage product B, reflecting the increased risk. In this way, enhanced customers segmentation and product design initiatives converge to benefit consumers and their sources of debt financing, to the benefit of each.

[09] To understand the potential impact of national prepayment scoring standard, as manifested in the present invention, one need look no farther than the existing default risk scoring standard, owned and distributed by Fair, Isaac and Company, Inc. (Fair Isaac) for over 30 years. By establishing a standard methodology for scoring borrower default risk, and broadly disseminating it, Fair Isaac dramatically enhanced mortgage lender insight into expected loan dynamics. In finance, enhanced insight is synonymous with enhanced information. Enhanced information implies reduced risk for the lender. Finally, reduced lender risk profiles produce lower costs of capital. In other words, because Fair Isaac standardized successfully a fungible measurement of default risk, more money is available for consumers to borrow, at better and cheaper interest rates. The market is more efficient than before and everyone benefits.

[10] To further qualifying the timeliness of the invention, please refer to exhibit 1, "Green Tree chief returns \$23 million..." The Wall Street Journal, March, 1998. This story highlights the industry wide uncertainty surrounding prepayment speeds in consumer debt portfolios. One industry leading company, Green Tree Financial, "has been hit hard the past year by escalating loan losses in the painful recognition that its accounting has been too aggressive. Also, an unexpected wave of loan prepayments hit the industry, as borrowers sought lower interest rates, indicating working-class consumers were not as unsophisticated as lenders had believed." Stated plainly, Green Tree overstated prior year earnings significantly, exercising its option under GAAP accounting to roll forward and capture in advance projected lending profits, even though those very profits were merely estimated based in part on arbitrary prepayment assumptions. In large measure because Green Tree badly miscalculated these prepayments speed assumptions, in 1997 the company was forced to charge off \$390 million of 1996 reported profit. In 1998 the company was sold off to Conseco.

[11] Earlier disclosures in the area of prepayment scoring in a lending context are limited or nonexistent. United States Patent No. 5,696,907, entitled "System and Method for Performing Risk and Credit Analysis of Financial Service Applications," issued to Tom. The Tom patent discloses using a neural network to mimic a loan officer's underwriting decision making. The method of the Tom patent is based on a non-iterative regression process that produces an approval criterion that is useful in preparing new or modified underwriting guidelines to increase profitability and minimize losses for a future portfolio of loans. A prepayment observation is used in the neural net as a negative flag, but no prepayment scoring system is utilized in the

Tom patent.

- [12] In view of the prior art, there is a clear need for measuring and predicting a consumer's prepayment propensity, as well as a clear and strong need for a method and apparatus to produce such a measuring and predictive parameter.

BRIEF SUMMARY OF THE INVENTION

- [13] The system and method of the present invention generally works in the following manner: the service bureau or broker will electronically capture individual loan applications from consumers. Those loan applications will be sent to lenders for evaluation. The lender, using the present invention submits the loan application for review and analysis. The loan application will be reviewed by the present invention according to a sophisticated economic and customer behavior model, which will score the prepayment behavior of candidate borrowers. The score for these borrowers, which is an index of their prepayment propensity, will be electronically returned to the lender. The lender will in turn use the prepayment score and calibrate an appropriate mortgage price including the setting of interest rates, fees, broker commissions, and potentially consumer rewards. Using this consumer scoring technique, a lending institution can seek to contact or contract with those consumers who display a low propensity to prepay.

- [14] The advanced scoring of customer prepayment propensities materially improves the lender's to risk profile as regards new lending customers. This novel insight adds value to the marketing, underwriting, lending, administrative process for first and second mortgages, credit card balance transfers, and asset-backed term loans such as

automobile loans. By assisting lenders in their efforts to segment customers according to this crucial behavior metric, waste and excess costs are driven from the lending economy. More money is thus available, more cheaply, for more people.

[15] To the borrower, this system offers several advantages. First, more favorable loan terms can be made to those consumers who exhibit a beneficial borrowing behavior, i.e., borrowers who are not likely to prepay their loans but instead maintain their loans for a profitable duration. Further, dealing with a stable borrower market results in a more favorable financial environment on for all lenders thereby mitigating the risk of loss and, in the normal course of all efficient markets, passing that financial advantage onto borrowers generally.

[16] Once again, the irrefutable economic relationship between financial risk-taking and expected financial reward informs the environment addressed by the present invention. If lenders reduce their risks-and by extension their costs-through enhanced prepayment scoring, ultimate borrowing costs paid by consumers will decline.

[17] For the loan originator, the system offers several advantages. The loan originator can more efficiently price the particular loan. Further the loan originator can more efficiently select brokers and intermediaries who will select the best borrowers. Further, the system and method of the present invention will lead to more efficient direct and indirect marketing investments by identifying individual consumers and groups of consumers who exhibit the most beneficial borrowing behavior, i.e., a propensity not to prepay financial obligations.

[18] Given that direct marketing costs are exploding as the conventional direct channels (e.g. mail and outbound telemarketing) become saturated, any available efficiency in the direct marketing process is highly desirable. For example, in the marketing of home equity lines of credit (i.e. second mortgages), direct-mail response rates are now, on average, running below 0.3% (i.e. below 3/10ths of one percent). Obviously, some fraction of even this small respondent sample will prove ill-suited, as regards prepayment behavior, for the debt product being marketed. Therefore, the tailoring of specific debt products to consumers of specific prepayment behavior characteristics is essential to the efficient pricing of debt instruments. Lead generation, third-party data acquisition, underwriting, yield spread calculations all directly inform debt instrument profitability, and are all beneficially affected by the present invention.

[19] Finally, in the context of sophisticated asset liability management (ALM), subtle prepayment behavior analysis provides significant benefits to its practitioners. Because ALM, as a primary objective, seeks to minimize destructive asymmetries in asset and liability cash flows, intelligent risk managers will utilize debt contracts of varying expected durations to strengthen their balance sheet. For example, a lender's risk manager may seek multiple classes of debt instrument, reflecting multiple prepayment profiles, in order to assure himself of adequate incoming cash flow to sustain his expected liability cash outflows. In the matching, therefore, of expected cash in- and out-flows, the prudent risk manager utilizes a carefully segmented portfolio of debt instruments scored by prepayment propensities (and other measures) and priced accordingly, to avert liquidity crises.

[20] An additional, equally valuable use of the present invention is in the valuation of existing mortgage or debt instrument blocks of business. This valuation may be required by lender risk managers, auditors, regulators, or investors; it may reflect stakeholder interest in actively managing asset-liability risk, or it may be performed as part of the merger and acquisition appraisal. In all instances, the prepayment scoring system quantifies from a granular perspective upward to a pool, or block perspective, the prepayment speed characteristics of the debt instruments. As we have seen in the Green Tree case, failing to adequately price prepayment risk has enormous balance sheet implications, and typically leads one to grossly over value a portfolio or the enterprise itself.

[21] For auditors, the system of the present invention offers a quantitative measure of prepayment risk thus reducing auditor exposure to "claw-back" write-downs. This situation occurs in the case of issuers that secure these mortgages and, under the generally applied accounting procedures (GAAP) accelerate and capture earnings based on certain prepayment assumptions. If those prepayment assumptions are incorrect, prior year financial statements are incorrect and massive charges are required to reflect lower portfolio earnings.

[22] For banking regulators, the system of the present invention offers the ability to quantify balance sheet risk resulting from expected consumer prepayment behavior. This will allow regulators to more precisely measure and assign minimum bank capital levels.

[23] For credit rating agencies, the ability to score according to an objective, standard

methodology prepayment risk provides enormous assistance in rating a lender's creditworthiness. Rating agencies function, effectively, as credit market bellweathers. Lending institutions are dependent on favorable credit ratings in order to float their institutional debt at advantageous rates; rating agencies, as in the case of regulators, evaluate carefully lenders' claims of capital adequacy; the capital (cash reserves) retained by lenders is directly and immediately affected by debt instrument prepayment speeds. This is because, under GAAP accounting rules, lenders are allowed to capture a substantial percentage of the future expected profits for a given contracted debt instrument, and those profits are themselves substantially dependent on the assumed life of the instrument. (In the case of subprime mortgages, for example, profits may double if the mortgage is maintained in force for four years instead of three). If those profits are overstated, they must be reversed, with resultant charges reducing lender capital (capital: paid-in cash investments plus retained profits). Therefore, rating agencies must scrutinize lender portfolio prepayment speed assumptions, because if those assumptions prove false, then the lender will suffer a reduction in capital. Any significant impairment of lender capital necessarily suggests a reduction in its credit rating. Credit rating agencies will be major beneficiaries and users of the present invention.

- [24] For investment bankers, the system of present invention establishes a standardized prepayment methodology that allows merger and acquisition advisers to be able to quantitatively measure the balance sheet risk in a target banking or mortgage company. In addition, investment bank usage of the present invention will include its application to debt instrument securitization. Securitization describes the process

by which pools of mortgage or other debt instruments are purchased by investment banks-in their capacity as underwriters-and re-sold to institutional and public investors as reconstituted securities. Typically, these securitizations benefit originators of debt, because they realize significant acceleration in realized profits; they also significantly diversify their risks by selling significant aspects of the debt instrument to asset underwriters and others. However, the typical debt instrument securitization proceeds with the originating lender retaining significant prepayment risk; if prepayment speeds accelerate beyond levels assumed in the securitization pricing process, the originating lender is held responsible. Hence the invention, by measuring the expected prepayment behavior and scoring in according to an accepted, industry standard method, will improve the securitization process and render it more efficient. Once again, this will reduce costs for all participants and free up more capital for lower-cost consumer borrowing.

[25] For investors, the method of the present invention provides a way to make investment decisions based upon quantified debt instrument prepayment behavior risk for lending institutions in which investors might want to invest, or to evaluate the relative stability of mortgage securities that are backed by individual debt instruments.

[26] These and other advantages of the present invention are described in reference to the specification that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[27] **Figure 1** is an overview of the process of the present invention.

- [28] **Figure 2** is a block diagram of the present invention.
- [29] **Figure 3** is a block diagram showing the user interface module connections.
- [30] **Figure 4** is block diagram showing the interactions with the prepayment historical data.
- [31] **Figure 5** is a block diagram showing the interactions with the econometric model.
- [32] **Figure 6** is a block diagram showing the factors that are used by the user interface module.

DETAILED DESCRIPTION OF THE INVENTION

- [33] Referring to **Figure 1**, an overview of the process of the present invention is shown. The mortgage broker or lending institution first obtains a loan application from a borrower **10**. That information is electronically transmitted to the present invention, which parses the information **12** of the loan application into various categories that are relevant to the scoring of the potential loan. The loan application contents are parsed based upon the information needs of a sophisticated, mathematical model resident in the present invention. A prepayment score is then derived **14** for the particular consumer as a function of the particular loan type being requested, and in further view of the interest rate environment in which the loan is being processed (i.e. rising or falling interest rates). As previously noted this score is an indication of the prepayment propensity of a particular consumer. The prepayment score is then returned to the lender **16**. Thereafter the lender can create a customized loan product that rewards favorable prepayment behavior of the

consumer 18.

[34] Referring to **Figure 2**, an overview of the system of the present invention is shown. A loan originator **20** receives the application from a potential consumer. That application is then input to the loan originator's data delivery channels **22**. Such data delivery channels **22** are (without limitation) e-mail, fax, Internet, and generally other electronic means. Other loan originators **34** also send their respective consumer applications over their own data delivery channels **36**.

[35] The present invention anticipates delivery of loan applications **24** over the Internet **28** or other digital electronic means such as wireless communications methods as well. Electronic loan applications **40** enter the system of the present invention through a communication server **42**. The loan information concerning a given consumer is then submitted to an application parser **52**. Application parser **52** divides the information into loan information **58** and applicant information **56**. Loan information **58** is information that relates to the amount, the term, down payment, loan type, and other information important and relating to the amount of money to be loaned. Applicant information **56** is information such as name, address, Social Security number, and other demographic information concerning the applicant.

[36] Loan information **56** is fed into a prepayment model library database **66**. The prepayment model library database **66** comprises information concerning prepayment historical data **62**. The results are fed into model training server **64** which processes prepayment historical data **62** of both an individual and demographic groups which in turn provides updates to the model library database **66**.

Once loan information 58 is processed by the prepayment model library database 66 an analytical prepayment model 60, which is based upon the loan information 58 is provided to the prepayment calculation server 46. Prepayment calculation server 46 receives additional information from econometric model 48 which establishes the relationship among the wide variety of variables. Econometric model 48 generates interest rate, mortgage rate and other economic parameters that, arrayed in time series, comprise scenarios utilized by the prepayment calculations server. These scenarios are generated from the Low Discrepancy Sequence (LDS) logic, rather than using random number generation. The LDS logic affords significantly higher model accuracy with the same number of scenarios.

[37] Once a prepayment score 44 is derived by prepayment calculation server 46, prepayment score 44 is sent to the communication server 42 and is transmitted over the Internet (or other electronic channels) 28 through the data delivery channels 22 or 36 back to loan originators 20 or 34 who can then either approve, disapprove, or create customized loan product for the consumer.

[38] Prepayment score 38 is calculated based upon the following model. The specific prepayment analysis of the present invention is conceptually shown below.

[39] The following variables:

[40] $A = (a_1, a_2, \dots, a_n)$

[41] $L = (l_1, l_2, \dots, l_m)$

[42] are vectors of the applicant's data and loan parameters.

[43] $E_s(t) = (e_{1s}(t), e_{2s}(t), \dots, e_{k_s}(t)); \quad s = 1, \dots, S$

[44] denotes a set of Low Discrepancy Sequence (LDS)-based scenarios of the econometric parameters, which have been generated by the RTH Linked Index Econometric Model. Thus the model is a set of stochastic differential equations that describe the dynamics and interaction of major macroeconomic indicators, each relevant to the prepayment propensity calculation.

[45] Analytical Prepayment Model \mathfrak{R} , which varies with the types of loan applied for, is trained to calculate prepayment value p_s in a given scenario based on the applicant's data (A), loan parameters (L), and econometric parameters (E):

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

[46] Total prepayment, accumulated by the time T in scenario s , can be calculated as:

$$P_s(T) = \prod_i p_s(t_i)$$

[47] Then, total prepayment at time T is given by:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

[48] Finally, the prepayment score is:

$$Score = \sum_T TP(T)$$

[49] The analytical model that produces the prepayment score may be further informed

by additional external behavioral or econometric factors, based on subsequent research, as well as the aforementioned behavioral scoring of mortgage broker behavior.

[50] The present invention may also be represented in an alternative embodiment in the form of the credit engineering workstation (CEW). This CEW (more fully described below) comprises a user interface which allows a loan originator to conduct all of the prepayment calculations, model analysis, and pricing of the present invention using the prepayment model first noted above.

[51] The CEW operates in either a Unix or Windows NT environment using Oracle, SQL server, Sybase, DB2, or Informix database support. The CEW also uses CORBA or, structured object models together with a JAVA/HTML browser based graphical user interface.

[52] The subroutines of the CEW all contribute to the end goal of determining the prepayment propensity of a consumer. For example, subroutines of the present invention deal supports the generation of various interest rate scenarios, and subsequent economic scenarios model fitting processes that fit the modeled interest rates scenarios to historical and current interest rate yield curve performance as well as to other macro economic indicators.

[53] Part of the system includes rewards pricing logic to efficiently measure and price the impact of rewards on consumer prepayment behavior. For example it would be most beneficial to a lender to reward the consumer for not prepaying the lender's loan. Such a reward could be assessed in terms of its impact on the consumer

prepayment behavior. The system therefore permits the end-user to design pro forma rewards structures and to test their impact on prospective consumer prepayment behavior.

[54] Various user definable screens also establish default spreads, prepayment spreads, broker commission schedules, and other financial factors that influence the pricing of the product to be offered to the consumer. Various other economic scenarios are collected via the user interface and combined with various probabilities and default data as well as other lender defined criteria result in rationally priced end-user mortgage contracts.

[55] Referring to **Figure 3**, further information concerning the CEW of the present invention shown. The system comprises user interface module **70** which is the basic graphical user interface and other software that allows an originator to provide information concerning a consumer who wishes to borrow money from lender. The user interface module allows the collection of loan attributes **76**, applicant attributes **74**, and reward program attributes **72**. In addition user interface module **70** collects or calculates spreads, broker commissions and other costs associated with the loan **78**. Loan attributes **76** and other loan related costs are fed into pricing engine **84** which, with other information, assists in creating an appropriate loan price **86**.

[56] Loan attributes **76**, applicant attributes **74**, and reward program attributes **72** all which have an impact on the value of the loan are fed into prepayment calculation server **80**. Prepayment calculation server **80** receives input from the various prepayment model parameters and creates prepayment score **82**.

[57] Referring to **Figure 4**, a block diagram showing the interactions which are necessary to create a prepayment model are shown. Consumer information **96** which consists of applicant attributes **74** and loan attributes **76** are fed into a prepayment model fitting **92** module. Prepayment model fitting **92** establishes various prepayment model parameters **94** based upon prepayment historical data **90**. Once the appropriate prepayment model is created by prepayment model fitting **92**, a model is returned to the prepayment calculation server for the calculation of the prepayment score of the particular consumer given the type of loan to consumer is requesting. The prepayment calculation server also benefits from input from an econometric model scenario generator.

[58] Referring to **Figure 5**, the interactions for the econometric model are shown. Econometric model scenario generator **106** receives input from econometric model fitting module **104** and LDS scenarios **108**. Econometric model fitting module **104** receives information from econometric historical data **100** and current market environment **102** which comprises, without limitation, information concerning rising or falling interest rates and trends. The information from econometric historical data **100** concerns the demographic group to which the consumer belongs and other econometric information such as age, income, credit rating, occupation and other factors. The information from current market environment **102** concerns the direction and velocity of changes to interest rates. Econometric model scenario generator **106** processes the information and produces various scenarios based on the information.

[59] Referring again to **Figure 3**, prepayment calculation server **80** creates prepayment score **44** for the particular consumer in question. Prepayment score **44** is based upon

the established prepayment model and the generated econometric model.

Prepayment score **44** is transmitted to the pricing engine **82** to establish the pricing of the loan product to be offered to the consumer in question.

[60] Referring to **Figure 6**, additional parameters which the user interface module uses to create the various scenarios are shown. Additional aspects of the present invention provide for creation of new products. Strategy optimizer **122** is based upon acceptance of offered products by consumers and input from and relating to other products are on the market. Strategy optimizer **122** generates marketing plans based upon individual lenders' portfolios. Such a market plan could assist the lender in offering new products to the marketplace that are more profitable for the lender. The system includes targeting optimizer **124** which provides a way to offer loan products to those consumers having the most favorable prepayment characteristics, i.e., a low propensity to prepay loans made. The system also comprises loyalty optimizer **126** which models and defines offers and other inducements to consumers to reward financially advantageous consumer behavior. Channel optimizer **128** is part of the present invention. Channel optimizer **128** analyzes the channels of delivery of financial product offerings to evaluate and determine the channel that is the most efficient way to deliver various financial products. The system also comprises database optimizer **130** which receives and organizes information in the various databases to constantly build and refined prepayment historical data **90** and econometric historical data **100**.

[61] The target platform on which the system of the present invention will run is either an Intel Pentium processor based system with typically 32 megabytes of RAM, hard

disk storage and retrieval, and communications capability using the TCP/IP protocol. Alternatively the system will also run under the UNIX operating system on a Sun Solaris platform. In both cases displays for users are anticipated as is the ability to output hard copy reports. In typical operation, a plurality of users, remote from the system site will access the system via private networks or over the Internet to send the information necessary for the present invention to make the desired calculations leading to the prepayment score. This score is then sent back to the requesting user at the remote terminal.

[62] Although described herein with respect to a mortgage loan or loan, the present invention is applicable to numerous financial instruments that have a value that depends on the particular consumer's actions over time. The value of typical debt instruments, such as, but not limited to, mortgages, second mortgages, home equity loans, car loans, school loans, term loans, leases, credit card accounts, and credit card balance transfers, depend on a continued stream of cash and are therefore affected significantly by prepayment.

[63] The value of other instruments that depend on the cash stream over time, such as open-end car leases and whole-life insurance policies, can also depend on the consumer's actions, and therefore, for purposes of this invention can be considered as a form of debt instrument. In the car lease scenario, predicting the probability of a consumer electing to purchase or return the car before the end of the lease (prepay) is important in determining the value of the lease. Even a consumer's predisposition to keeping (purchasing at residual value price, a type of prepayment) or returning the car at the end of the lease can be used to modify the lease terms to the leasing entity's

advantage.

[64] Likewise, the likelihood of a consumer to cash out the surrender value of a whole-life insurance policy (another form of prepayment, albeit in the opposite direction, that ends the stream of cash) can significantly affect the ultimate value of the policy to the insurer.

[65] Known database and computer-based data mining techniques can be used for analyzing: the value of financial instruments (and portfolios in which they are packaged) based on the prepayment score associated with each of them; the risk associated with portfolios containing the financial instruments; and the pricing for servicing those portfolios. Additionally, instruments can be packaged together into portfolios based, at least in part, on the prepayment scores of the applicants.

[66] A system and method for prepayment score generation has been described. Those skilled in the art will appreciate that other variations of the present invention are possible without departing from the scope of the invention as described.

WHAT IS CLAIMED IS:

- [c1] A system for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:
- at least one debt instrument origination computer terminal for accepting and transmitting a debt instrument application of an individual applicant;
 - a computer network connected to the at least one debt instrument origination computer terminal for receiving the transmitted debt instrument application of the individual applicant;
 - a communication server connected to the computer network for receiving the transmitted debt instrument application of the individual applicant;
 - an application parser connected to the communications server for receiving the transmitted debt instrument application of the individual applicant from the communications server and parsing the information into debt instrument information and applicant information;
 - a prepayment model library database comprising debt instrument prepayment models connected to the application parser for receiving the debt instrument information and fitting the debt instrument information into the debt instrument prepayment models and for transmitting debt instrument prepayment models that match the debt instrument information; and
 - a prepayment calculation server comprising a prepayment score generation model connected to the prepayment model library database for receiving the debt instrument

prepayment models and calculating a prepayment score for the debt instrument application of the individual applicant based upon the debt instrument prepayment model and the prepayment score generation model, the prepayment calculation server being further adapted to transmit the prepayment score to at least one debt instrument origination computer terminal via the communications server and the computer network;

where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment; and

wherein the at least one debt instrument origination computer terminal is adapted to use the prepayment score to adjust terms of the debt instrument of the individual applicant.

[c2] The system for determining a prepayment score of claim [c1], where the prepayment model library database further comprises:

a model training server for creating the debt instrument prepayment models for the prepayment model library database; and

prepayment historical data storage means connected to the model training server, the prepayment historical data further comprises prepayment statistics regarding debt instruments of various types.

[c3] The system for determining a prepayment score of claim [c1], where the prepayment calculation server further comprises an econometric model that

generates Low Discrepancy Sequence (LDS)-based scenarios of econometric parameters for input to the prepayment calculation server.

- [c4] The system for determining a prepayment score of claim [c1], further comprising means adapted to calculate a total prepayment at time T from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

- [c5] The system for determining a prepayment score of claim [c4], further comprising means adapted to calculate the total prepayment, accumulated by time, in scenario s from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

- [c6] The system for determining a prepayment score of claim [c5], further comprising means adapted to calculate the prepayment value in a given scenario from the formula:

$$p_s(t) = \Re (A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \Re is an analytical prepayment model.

[c7] The system for determining a prepayment score of claim [c1], where the applicant is either an individual consumer or an individual household.

[c8] The system for determining a prepayment score of claim [c1], further comprising computer-based means for using data associated with the prepayment score of the applicant and terms of the debt instrument to determine a calculation selected from the group consisting of: a value of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c9] A method for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:

collecting debt instrument and applicant information at a debt instrument originator;

transmitting the debt instrument and applicant information over a network;

receiving the debt instrument and applicant information at a service bureau;

the service bureau calculating a prepayment score the individual applicant, where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment;

the service bureau returning the prepayment score over the network to the debt

instrument originator; and

the debt instrument originator using the prepayment score to customize a debt instrument product for the individual applicant.

- [c10] The method for determining a prepayment score of claim [c9], where calculating a prepayment score for the applicant comprises parsing the information into debt instrument information and applicant information.
- [c11] The method for determining a prepayment score of claim [c10], further comprising providing the applicant information to a prepayment model library database and the debt instrument information to a prepayment calculation server.
- [c12] The method for determining a prepayment score of claim [c11], further comprising the prepayment model library determining the prepayment model that best applies to the debt instrument information and providing that prepayment model to the prepayment calculation server.
- [c13] The method for determining a prepayment score of claim [c12], further comprising the prepayment calculation server receiving a prepayment model and an econometric model, where the prepayment calculation server further calculates a prepayment score for the applicant.
- [c14] The method for determining a prepayment score of claim [c13], where the total prepayment at time T is calculated from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

[c15] The method for determining a prepayment score of claim [c14], where the total prepayment, accumulated by time, in scenario s is calculated from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

[c16] The method for determining a prepayment score of claim [c15], where the prepayment value in a given scenario is calculated from the formula:

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \mathfrak{R} is an analytical prepayment model.

[c17] The method for determining a prepayment score of claim [c9], where the applicant is defined as an individual consumer or an individual household.

[c18] The method for determining a prepayment score of claim [c9], further comprising rating a broker based on prepayment scores of applicants that are clients of said broker.

[c19] The method for determining a prepayment score of claim [c9], further comprising using the prepayment score of the applicant and terms of the debt instrument to assist in determining a calculation selected from the group consisting of: a value

of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c20] The method for determining a prepayment score of claim [c9], further comprising packaging said debt instrument into a portfolio based, at least in part, on the prepayment score of the applicant.

Abstract of the Disclosure

A method and apparatus is disclosed for determining the prepayment propensity of individual borrowers. Early payment of debt instruments, such as loans and leases, can lead to losses being suffered by lenders. The present invention analyzes the demographics associated with a particular borrower to determine both the individual and group based prepayment propensity. The history of the borrower, the history of the borrower's demographic group, interest rate trends and other factors are then used to calculate a prepayment score that can be used by the lender to determine the propensity of a given borrower to prepay the instrument in question. The score of the individual borrower can be used to estimate the profitability of a debt instrument and allow the lender to make appropriate adjustments prior to issuing the instrument. The individual prepayment scores of a lender's or broker's clients can also be used to rate the lender or broker.

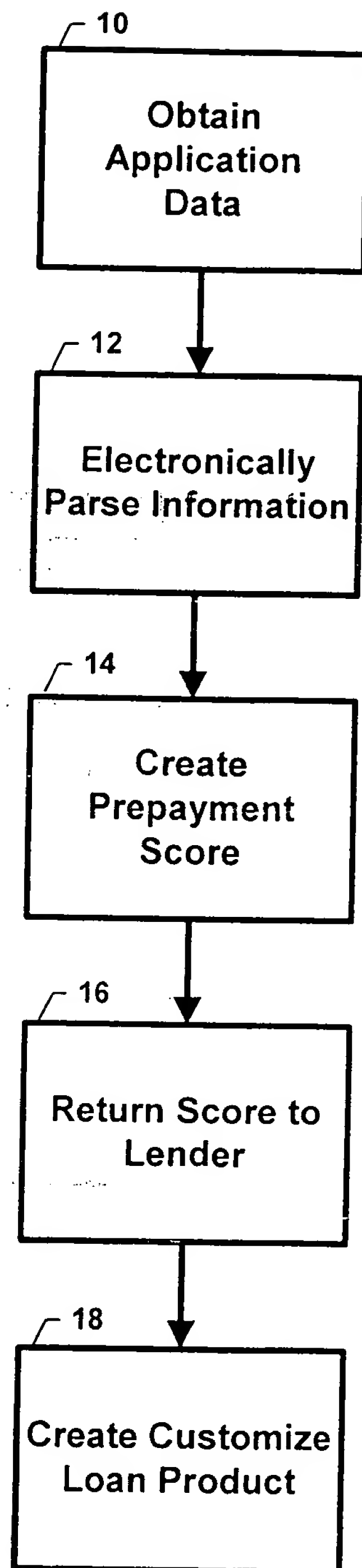


FIGURE 1

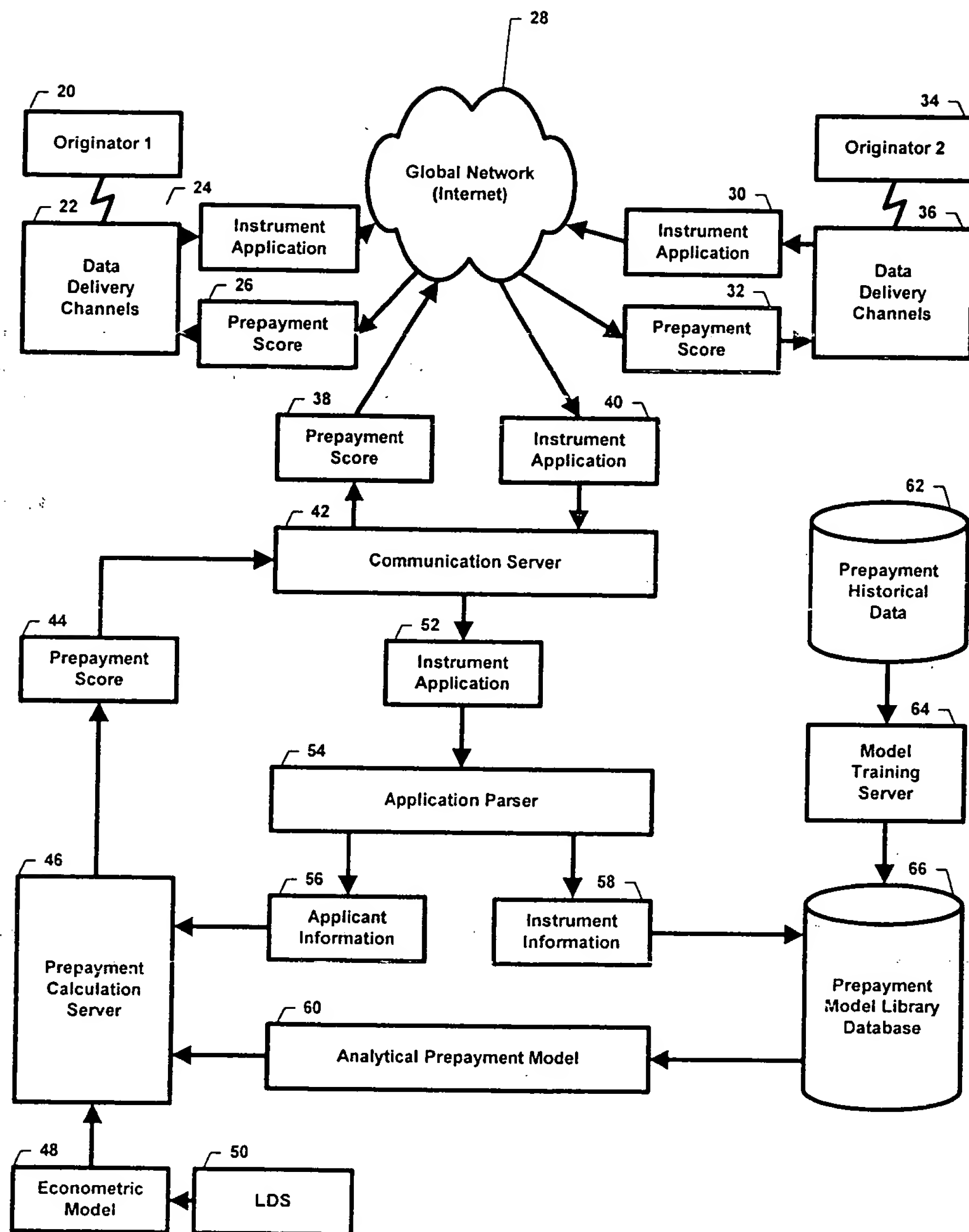


FIGURE 2

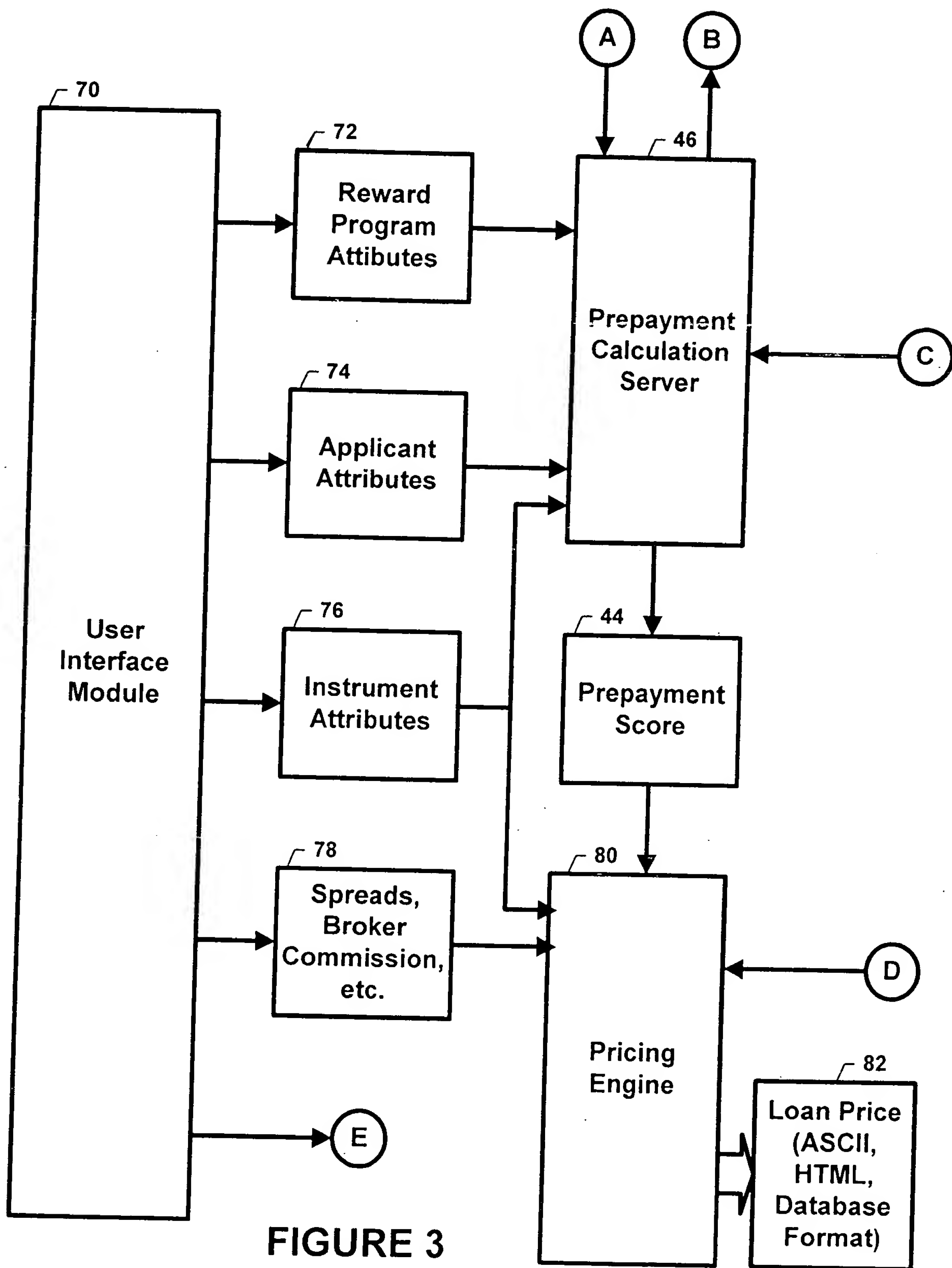


FIGURE 3

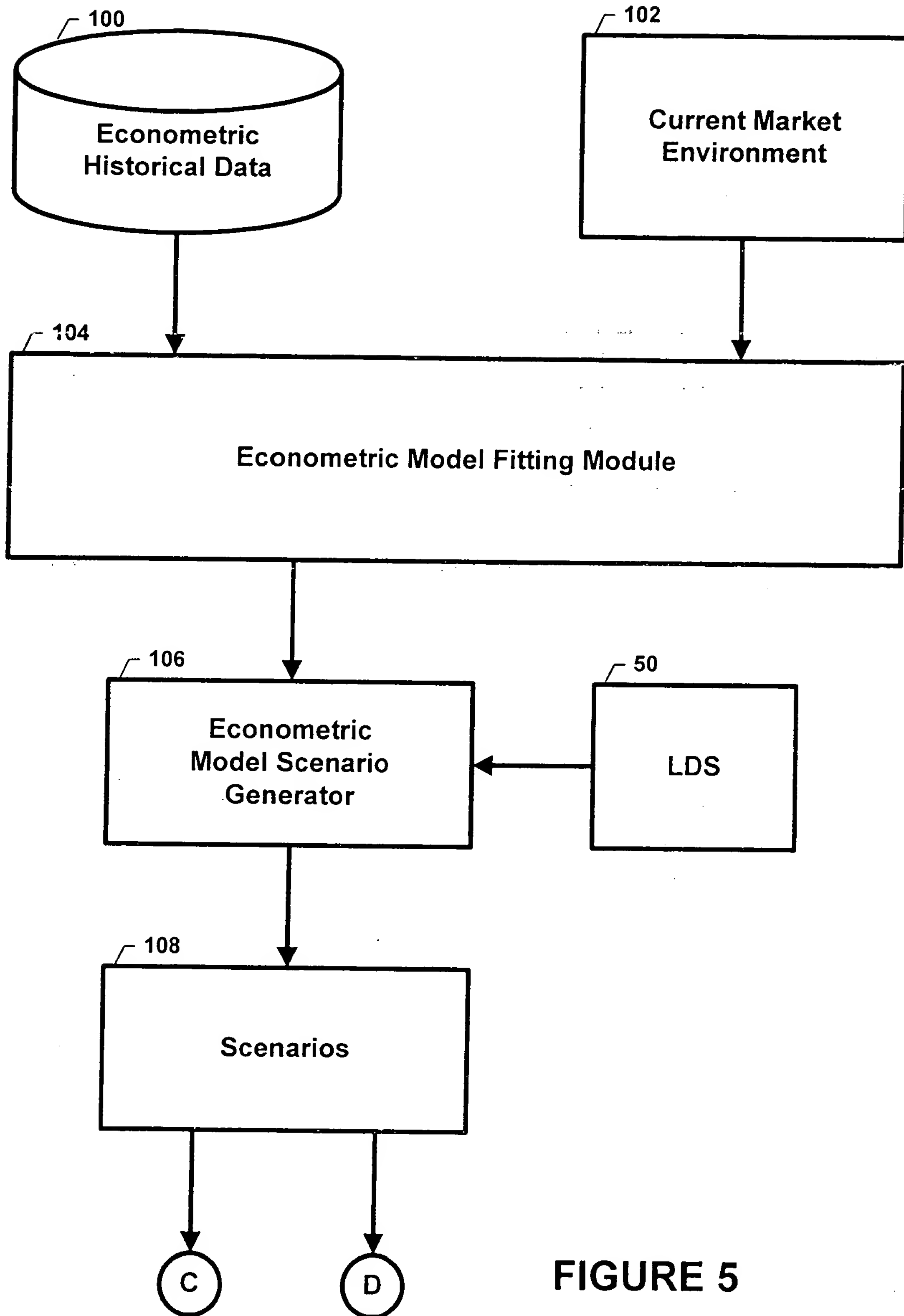


FIGURE 5

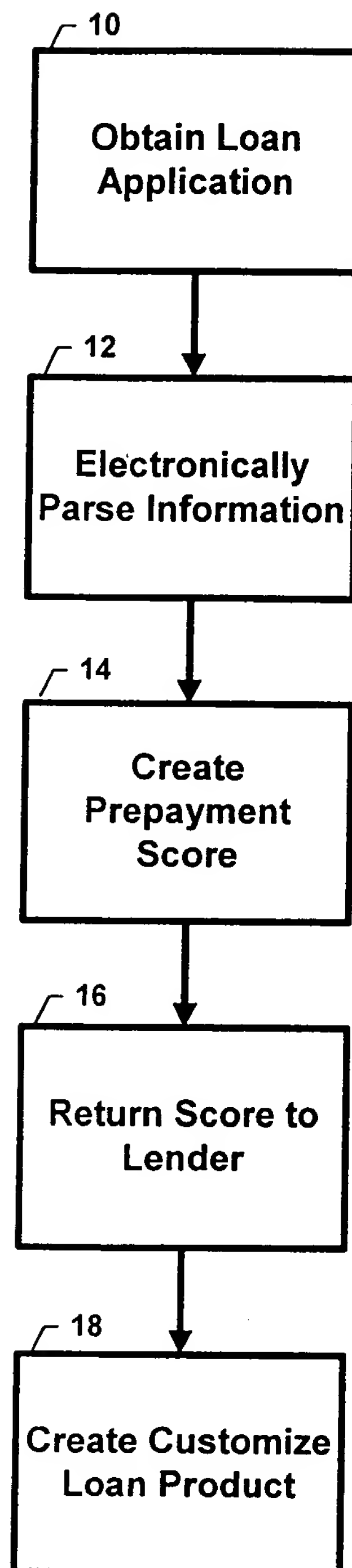


FIGURE 1

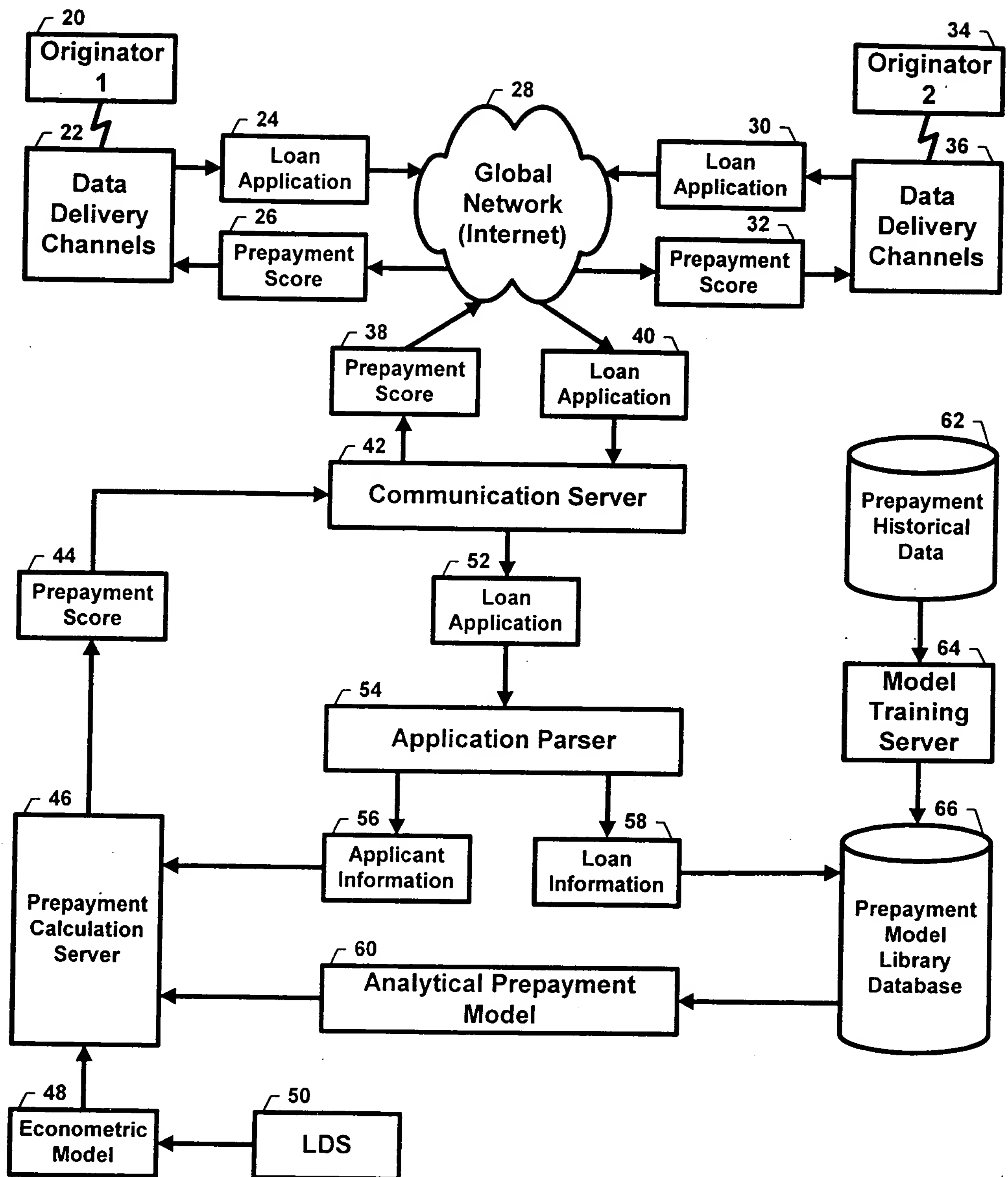


FIGURE 2

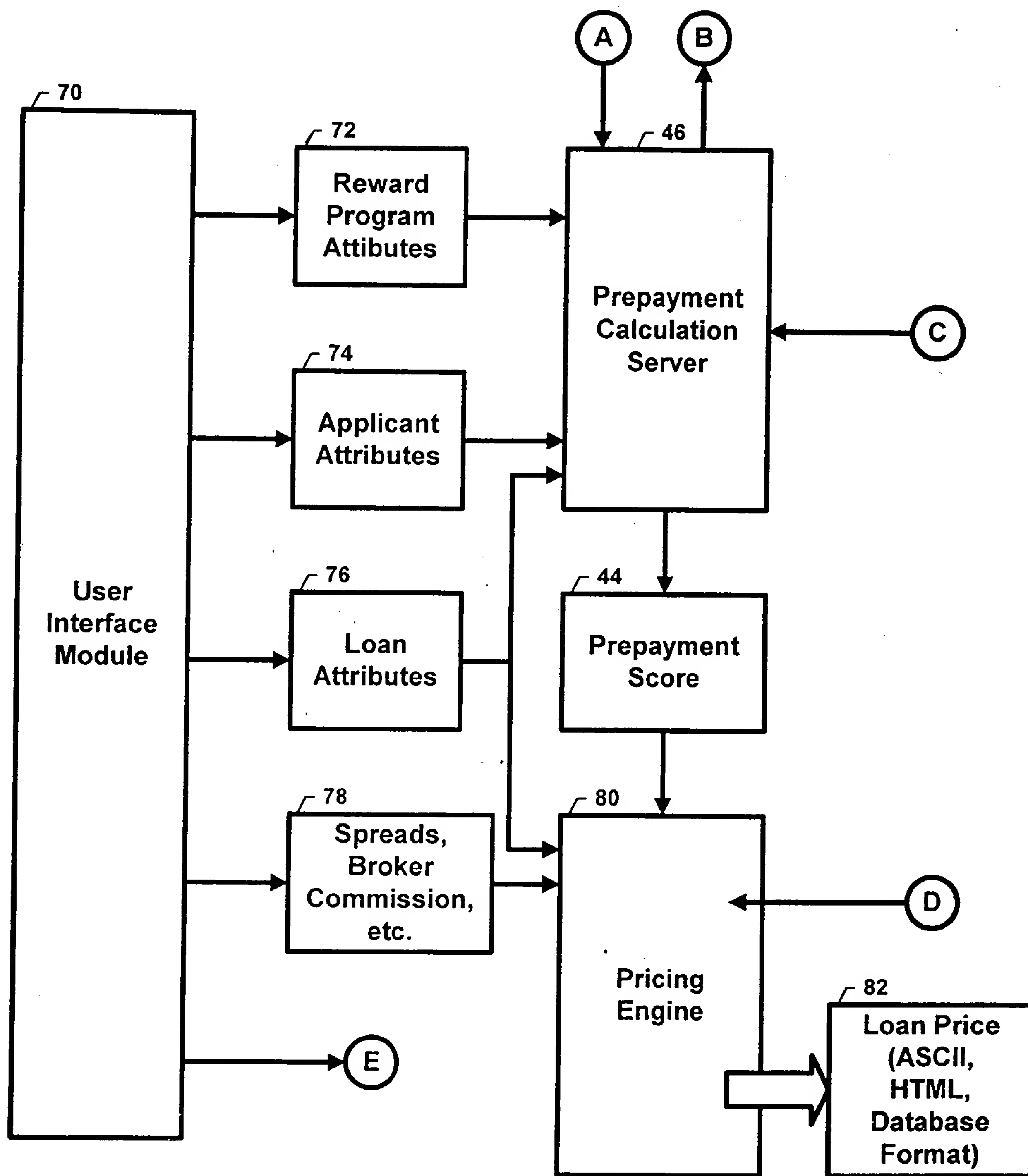


FIGURE 3

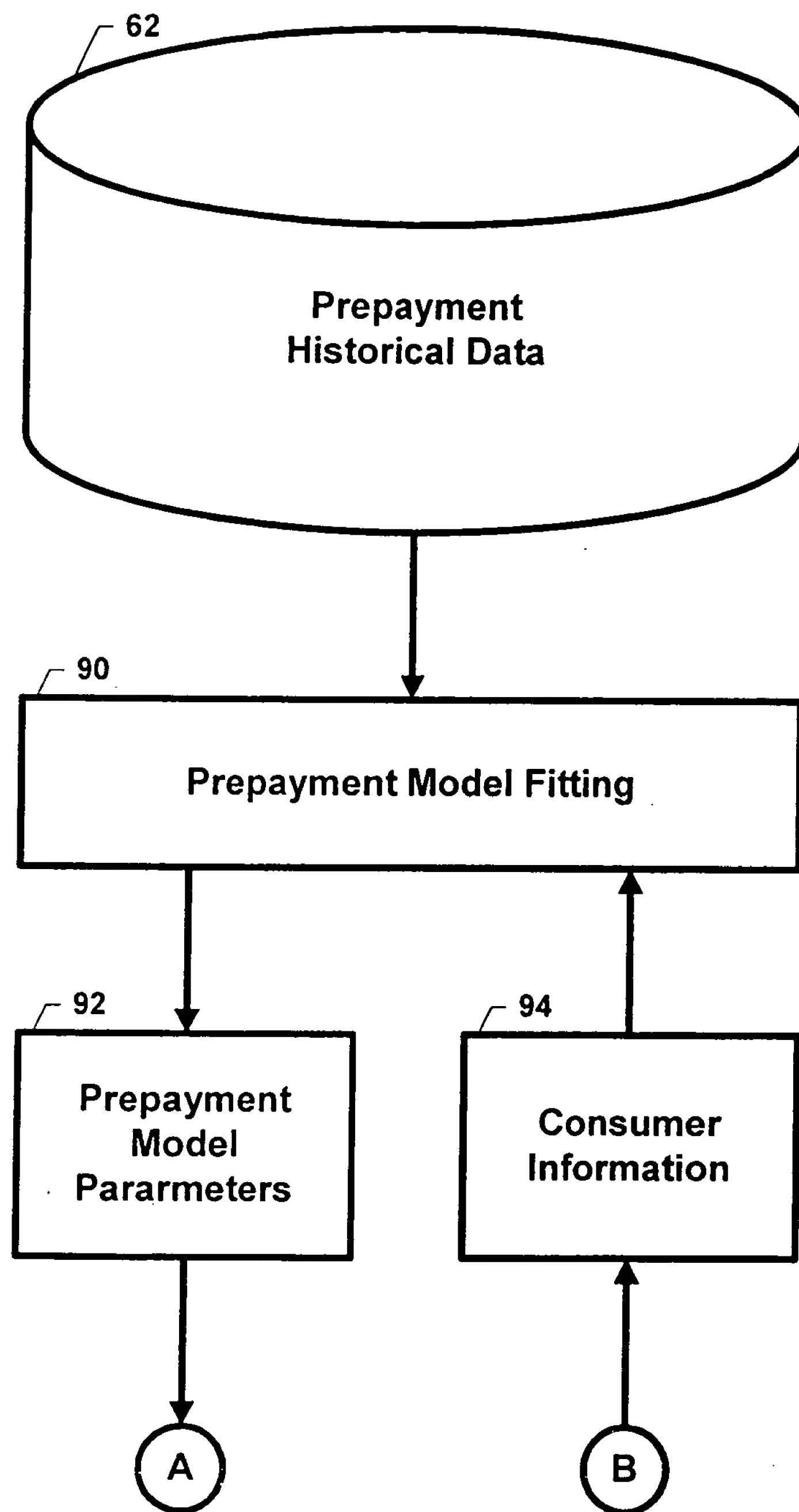


FIGURE 4

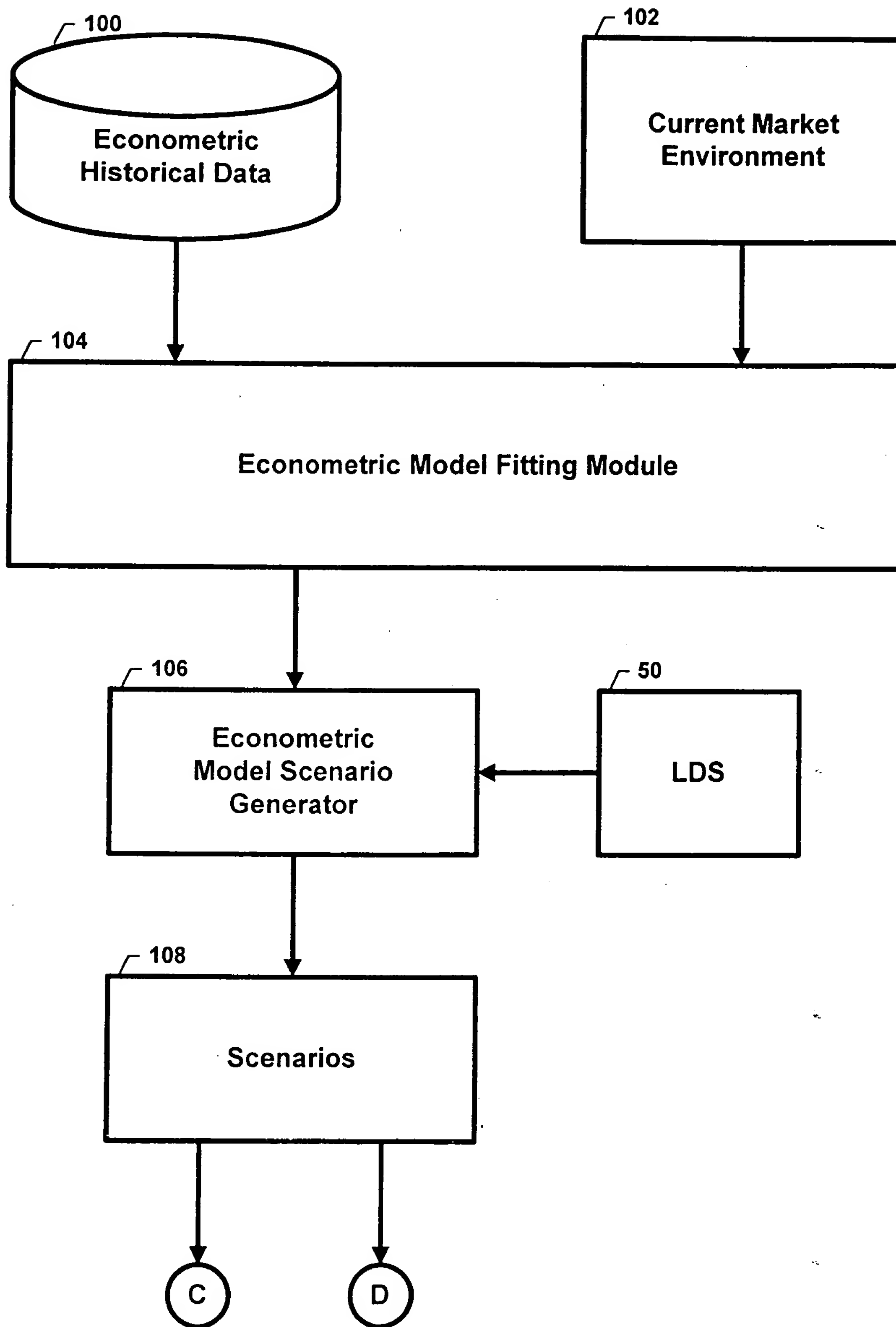


FIGURE 5

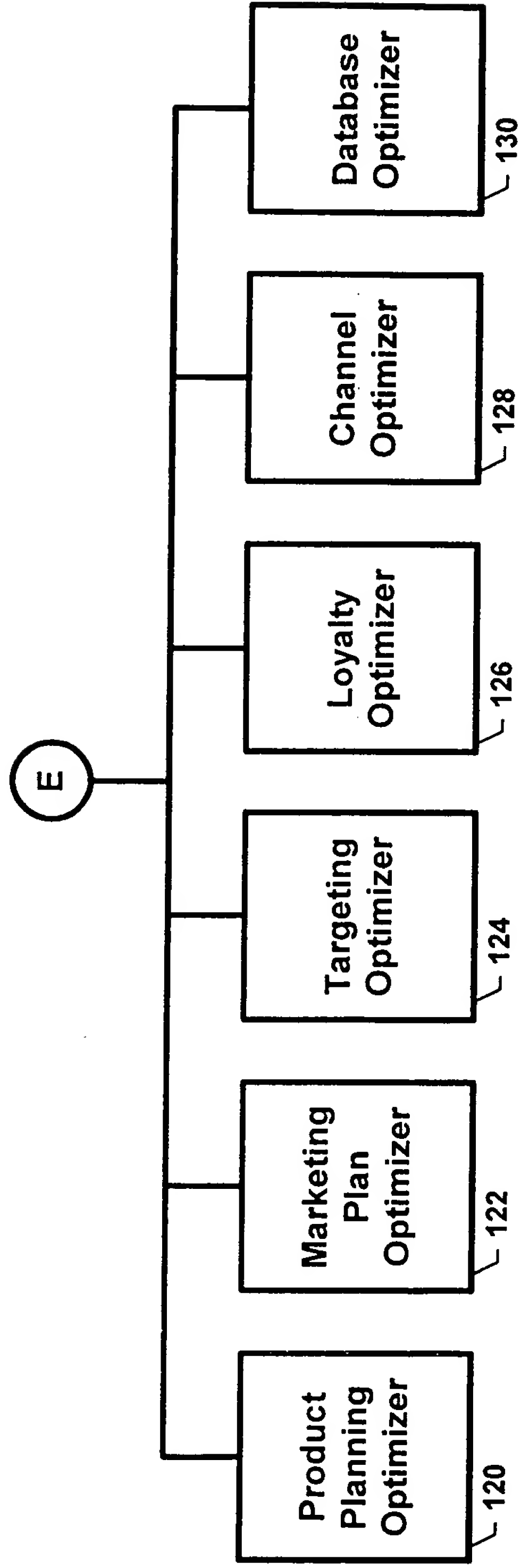


FIGURE 6

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	: Yuri Galperin, et al.
Appl. No.	: 09/942,983
PCT Filing Date	: August 30, 2001
For	: METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT
Examiner	: Siegfried E. Chencinski
Group Art Unit	: 3692

STATEMENT OF CHARLES L. JONES III UNDER 37 C.F.R. § 1.48(a)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Charles L. Jones III, do declare as follows:

1. I am a citizen of the United States and reside at _____.
2. The above-referenced patent application was filed on August 30, 2001 listing Yuri Galperin, Vladimir Fishman and William A. Eginton as the joint inventors.
3. I believe that I, Charles L. Jones III, should also be named as an inventor in the above-referenced application.
4. The inventorship error occurred without deceptive intent on my part.

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or document, or any registration resulting therefrom.

Dated: _____

Charles L. Jones III

ASSIGNMENT

WHEREAS, I, Charles L. Jones III, residing at _____, am a joint inventor, along with Yuri Galperin, Vladimir Fishman, and William A. Eginton, of certain new and useful improvements in a METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT for which we have filed an application for Letters Patent in the United States, Application No. 09/942,983 Filed on August 30, 2001;

AND WHEREAS, MarketSwitch Corporation (hereinafter "ASSIGNEE"), a Delaware corporation, with its principal place of business at 2350 Corporate Park Drive, Suite 400, Herndon, VA 20171, desires to acquire the entire right, title, and interest in and to said improvements and said Application:

NOW, THEREFORE, in consideration of the sum of One Dollar (\$1.00) to me in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, I, said inventor, do hereby acknowledge that I have sold, assigned, transferred and set over, and by these presents do hereby sell, assign, transfer and set over, unto said ASSIGNEE, its successors, legal representatives and assigns, the entire right, title, and interest throughout the world in, to and under said improvements, and said application including all provisional applications relating thereto (including but not limited to U.S. Provisional Application No(s). 60/228,954, filed August 31, 2000 (respectively if plural applications)), and all divisions, renewals and continuations thereof, and all Letters Patent of the United States which may be granted thereon and all reissues and extensions thereof, and all rights of priority under International Conventions and applications for Letters Patent which may hereafter be filed for said improvements in any country or countries foreign to the United States, and all Letters Patent which may be granted for said improvements in any country or countries foreign to the United States and all extensions, renewals and reissues thereof; and I hereby authorize and request the Commissioner of Patents of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents on applications as aforesaid, to issue all Letters Patent for said improvements to said ASSIGNEE, its successors, legal representatives and assigns, in accordance with the terms of this instrument.

AND I DO HEREBY sell, assign, transfer, and convey to ASSIGNEE, its successors, legal representatives, and assigns all claims for damages and all remedies arising out of any violation of the rights assigned hereby that may have accrued prior to the date of assignment to ASSIGNEE, or may accrue hereafter, including, but not limited to, the right to sue for, collect, and retain damages for past infringements of said Letters Patent before or after issuance.

AND I HEREBY covenant and agree that I will communicate to said ASSIGNEE, its successors, legal representatives and assigns, any facts known to us respecting said improvements, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuing and reissue applications, make all rightful oaths and generally do everything possible to aid said ASSIGNEE, its successors, legal representatives and assigns, to obtain and enforce proper patent protection for said improvements in all countries.

IN TESTIMONY WHEREOF, I hereunto set my hand and seal this _____ day of _____, 20__.

Charles L. Jones III

STATE OF _____ }
COUNTY OF _____ } ss.

On _____, before me, _____, notary public, personally appeared **Charles L. Jones III** personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged to me that he executed the same in his authorized capacity(ies), and that by his signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

[SEAL]

Notary Signature

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Second inventor: **Vladimir Fishman**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Third inventor: **William A. Eginton**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Fourth inventor: **Charles L. Jones III**

Inventor's signature _____

Date _____

Residence: _____

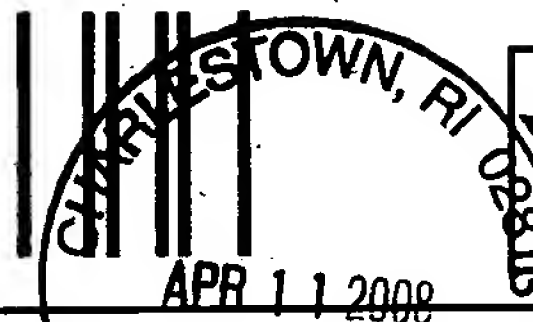
Citizenship: _____

Mailing Address: same as above

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- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Charles L Jones III
 4570 Old Post Road
 Charlestown, RI
 02813-2560

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X

[Signature]

☐ Agent

☐ Addressee

B. Received by (Printed Name)

C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes

If YES, enter delivery address below:

☐ No

3. Service Type

☒ Certified Mail

☐ Express Mail

☐ Registered

☐ Return Receipt for Merchandise

☐ Insured Mail

☐ C.O.D.

4. Restricted Delivery? (Extra Fee)

☐ Yes

2. Article Number

(Transfer from service label)

7006 0100 0004 5806 4397

PS Form 3811, February 2004

Domestic Return Receipt

102595-02-M-1540

EXP.046A



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Yuri Galperin, et al.
Appl. No. : 09/942,983
PCT Filing Date : August 30, 2001
For : METHOD AND APPARATUS
FOR DETERMINING A
PREPAYMENT SCORE FOR AN
INDIVIDUAL APPLICANT
Examiner : Siegfried E. Chencinski
Group Art Unit : 3692

PETITION UNDER C.F.R. § 1.47(a) TO ACCEPT DECLARATION SIGNED BY THREE OF
FOUR INVENTORS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicants hereby petition the Commissioner under 37 C.F.R. 1.47(a) to accept the enclosed Declaration signed by three of the four named joint and co-inventors. Charles L. Jones III refused to join this application or could not be reached despite diligent effort. Applicants submit with this Petition the following:

1. Declaration of Inventorship signed by Yuri Galperin, Vladimir Fishman, and William Eginton. In accordance with *M.P.E.P.* § 409.03(a), the Declaration, signed by all available inventors with the signature block of the nonsigning inventor left blank, is a declaration on behalf of the signing inventors and the nonsigning inventor Charles L. Jones III.

2. A Declaration of Ted M. Cannon, including attached Exhibits A-I, detailing the circumstances of the nonsigning inventor's refusal to join in this application or the assignee's inability to reach the nonsigning inventor despite diligent effort.

3. Payment in the amount of \$200.00 as required by 37 C.F.R. § 1.17(g) is included as listed on the transmittal letter.

05/01/2008 TL0011 00000003 09942983
04 FC:1463

200.00 0P

App. No. : 09/942,983
Filed : August 30, 2001

Applicants further state that the last known address of Charles L. Jones III is 4570 Old Post Road, Charlestown, RI 02813-2560. As set forth in the Declaration of Ted M. Cannon, Applicants obtained this last known address upon sending a letter to Mr. Jones' previous address and receiving the letter back as undeliverable with a notice that Mr. Jones forwarding address is the 4570 Old Post Road address.

In view of the foregoing submissions and to preserve the right of the owners of the above-referenced patent application in the subject invention, Applicants respectfully request permission to prosecute the above-referenced application on behalf of the joint and-co-inventors, Yuri Galperin, Vladimir Fishman, William Eginton, and Charles L. Jones III.

As indicated, payment in the amount of \$200.00 as required by 37 C.F.R. § 1.17(g) has been listed in the fees calculated on the transmittal letter. The Assistant Commissioner is authorized to charge any additional fees, including any fees for any required additional extension of time, or credit any overpayment, to Deposit Account No. 11-1410.

Respectfully Submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 4/28/2008

By: Ted M Cannon
Ted M. Cannon
Registration No. 55,036
Attorney of Record
2040 Main Street, 14th Floor
Irvine, CA 92614

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

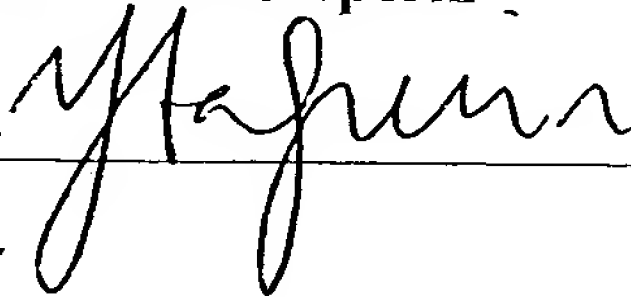
Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature



Date

8/13/2007

Residence:

3100 Franklins Way, Oak

VA

Citizenship: USA

Mailing Address: same as above

Page 2

Attorney's Docket No. EXP.046A

Full name of Second inventor: Vladimir Fishman

Inventor's signature Date 04/21/08Residence: 339 Main St Farmington, CT 06032

Citizenship: USA

Mailing Address: same as above

Full name of Third inventor: William A. Eginton

Inventor's signature Date 1/31/2008Residence: 211 Cornwall St NW Leesburg VA 20176

Citizenship: USA

Mailing Address: same as above

Full name of Fourth inventor: Charles L. Jones III

Inventor's signature _____

Date _____

Residence: 4570 Old Post Road, Charlestown, RI 02813-2560Citizenship: USA

Mailing Address: same as above

Send Correspondence To:
KNOBBE, MARTENS, OLSON & BEAR, LLP
Customer No. 20,995

EXP.046A



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Yuri Galperin <i>et al.</i>)	Group Art Unit 3692
)	
App. No.	:	09/942,983)	
)	
Filed	:	August 30, 2001)	
)	
For	:	METHOD AND APPARATUS FOR)	
		DETERMINING A PREPAYMENT)	
		SCORE FOR AN INDIVIDUAL)	
		APPLICANT)	
)	
Examiner	:	Siegfried E. Chencinski)	
)	

DECLARATION OF TED M. CANNON

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Ted M. Cannon, declare and state:

1. I am a partner in the law firm Knobbe, Martens, Olson & Bear LLP. I am an attorney-of-record in the above-referenced application and am authorized to act in behalf of the assignee.

2. I am informed and believe that Laura Meltzer attempted to contact Charles L. Jones III to obtain his signature on a declaration of inventorship for the patent application and on a statement that he believes he should be named as an inventor in the above-referenced application and that he was omitted as an inventor without deceptive intent on his part, as set forth in the Declaration of Laura Meltzer submitted with Applicants' petitions filed on September 19, 2007.

3. Applicants' petitions filed on September 19, 2007 were dismissed in a decision mailed October 26, 2007.

App. No. : 09/942,983
Filed : August 30, 2001

4. Yuri Galperin, Vladimir Fishman, and William Eginton have signed the declaration of inventorship. A true and correct copy of the declaration of inventorship signed by Yuri Galperin, Vladimir Fishman, and William Eginton is attached hereto as Exhibit A.

5. Prior to December 17, 2007, I obtained, from the Assignee of the above-referenced application, a mailing address for Charles L. Jones III, as follows:

Charles L. Jones III
4 Anchorage Lane
Marblehead, MA 01945

6. On December 17, 2007, I sent a package via certified mail, return-receipt requested, to Charles L. Jones III at the address listed in paragraph 5, enclosing the following: (a) a copy of the above-referenced patent application, (b) the declaration of inventorship, (c) a Statement of Charles L. Jones III under 37 CFR 1.48(a) stating that Charles L. Jones III was erroneously omitted as an inventor of the above-referenced patent application without deceptive intent on his part, and (d) a letter asking Charles L. Jones III to sign the declaration of inventorship and the Statement of Charles L. Jones III under 37 CFR 1.48(a). Attached as Exhibit B are true and correct copies of the December 17, 2007 letter and the documents enclosed therewith.

7. On December 28, 2007, I received the package of paragraph 5 back from the post office, unopened, and marked as undeliverable due to expiration of a forwarding order. The returned package indicated the following forwarding address for Charles L. Jones III:

Charles L. Jones III
4570 Old Post Road
Charlestown, RI 02813-2560

Attached as Exhibit C is a true and correct copy of the notice from the post office indicating the above forwarding address for Charles L. Jones III.

8. On January 14, 2008 I sent a package via certified mail, return-receipt requested, to Charles L. Jones III at the new address listed in paragraph 7, enclosing the following: (a) a copy of the above-referenced patent application, (b) the declaration of inventorship, (c) a Statement of Charles L. Jones III under 37 CFR 1.48(a) stating that Charles L. Jones III was erroneously omitted as an inventor of the above-referenced patent application without deceptive intent on his part, and (d) a letter asking Charles L. Jones III to sign the declaration of

App. No. : 09/942,983
Filed : August 30, 2001

inventorship and the Statement of Charles L. Jones III under 37 CFR 1.48(a). Attached as Exhibit D are true and correct copies of the January 14, 2008 letter and the documents enclosed therewith.

9. On January 18, 2008, I received a signed receipt from the post office indicating that the January 14, 2008 letter was delivered to the address of paragraph 7. Attached as Exhibit E is a true and correct copy of the receipt.

10. On March 3, 2008 I again sent a package via certified mail, return-receipt requested, to Charles L. Jones III at the new address listed in paragraph 7, enclosing the following: (a) a copy of the above-referenced patent application, (b) the declaration of inventorship, (c) a Statement of Charles L. Jones III under 37 CFR 1.48(a) stating that Charles L. Jones III was erroneously omitted as an inventor of the above-referenced patent application without deceptive intent on his part, and (d) a letter asking Charles L. Jones III to sign the declaration of inventorship and the Statement of Charles L. Jones III under 37 CFR 1.48(a). Attached as Exhibit F are true and correct copies of the March 3, 2008 letter and the documents enclosed therewith.

11. On March 10, 2008, I received a signed receipt from the post office indicating that the March 3, 2008 letter was delivered to the address of paragraph 7. Attached as Exhibit G is a true and correct copy of the receipt.

12. On April 8, 2008 I again sent a package via certified mail, return-receipt requested, to Charles L. Jones III at the new address listed in paragraph 7, enclosing the following: (a) a copy of the above-referenced patent application, (b) the declaration of inventorship, (c) a Statement of Charles L. Jones III under 37 CFR 1.48(a) stating that Charles L. Jones III was erroneously omitted as an inventor of the above-referenced patent application without deceptive intent on his part, and (d) a letter asking Charles L. Jones III to sign the declaration of inventorship and the Statement of Charles L. Jones III under 37 CFR 1.48(a). Attached as Exhibit H are true and correct copies of the April 8, 2008 letter and the documents enclosed therewith.

13. On April 14, 2008, I received a signed receipt from the post office indicating that the April 8, 2008 letter was delivered to the address of paragraph 7. Attached as Exhibit I is a true and correct copy of the receipt.

App. No. : 09/942,983
Filed : August 30, 2001

14. Despite diligent effort to obtain Charles L. Jones III's signatures on the inventors' declaration and the Statement of Charles L. Jones III under 37 CFR 1.48(a), I have not received signed documents from Charles L. Jones III. Indeed, I have not received any communication from Charles L. Jones III.

15. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further declare that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Dated: 4/28/2008

By: Ted M. Cannon
Ted M. Cannon
Attorney-of-record
Reg. No. 55,036

5204480

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Page 2

Attorney's Docket No. EXP.046A

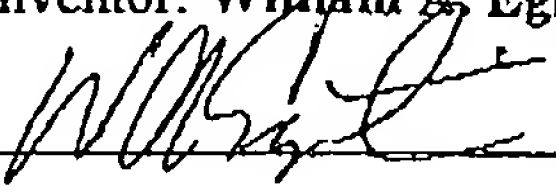
Full name of Second inventor: Vladimir Fishman

Inventor's signature Date 04/21/08Residence: 339 Main St Farmington, CT 06032

Citizenship: USA

Mailing Address: same as above

Full name of Third inventor: William A. Eginton

Inventor's signature Date 1/31/2008Residence: 211 Cornwall St NW Leesburg VA 20176

Citizenship: USA

Mailing Address: same as above

Full name of Fourth inventor: Charles L. Jones III

Inventor's signature _____

Date _____

Residence: 4570 Old Post Road, Charlestown, RI 02813-2560Citizenship: USA

Mailing Address: same as above

Send Correspondence To:

KNOBBE, MARTENS, OLSON & BEAR, LLP

Customer No. 20,995

Knobbe Martens Olson & Bear LLP

Intellectual Property Law

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www.kmob.com

Ted M. Cannon
949-721-2897
tcannon@kmob.com

December 17, 2007

VIA CERTIFIED MAIL
No. 7006 0100 0004 5806 4458

Charles L. Jones
4 Anchorage Lane
Marblehead, MA 01945

Re: Patent Application for Prepayment Score
Application No. 09/942983
Our Reference: EXP.046A

Dear Mr. Jones:

As you know, a patent application for your invention entitled METHOD AND APPARATUS FOR DETERMINING LOAN PREPAYMENT SCORE was filed on May 15, 1998 and assigned Application No. 09/078,867, which is now issued Patent No. 6,185,543. You, Yuri Galperin, Vladimir Fishman and William A. Eginton were listed as inventors on this application. A later related application was filed on August 30, 2001 and assigned Serial No. 09/942,983, but did not include you as an inventor. It is our understanding that you were erroneously left off this application through no deceptive intent on your part.

Therefore, we are filing a Petition with the U.S. Patent Office to correct inventorship on the related application. In order to correct inventorship we need you to sign a declaration acknowledging that you and the other three inventors are the inventors of this application. In addition, you need to sign a Statement indicating that you were erroneously left off this application through no deceptive intent on your part ("Statement").

I have enclosed a copy of the application as filed (including the specification, drawings and claims), the Statement and an Assignment of the invention to Marketswitch. Please review the application to confirm that you should be added as an inventor.

San Diego
619-235-8550

San Francisco
415-954-4114

Los Angeles
310-551-3450

Riverside
951-781-9231

San Luis Obispo
805-547-5580

Washington, DC
202-640-6400

Charles L. Jones
December 17, 2007
Page -2-

After your review, please sign and promptly return to me the Declaration, the Statement, and the Assignment in the pre-addressed envelope.

If you have any questions or if you would like to discuss this matter, please do not hesitate to contact me.

Sincerely

A handwritten signature in black ink, appearing to read "Ted M. Cannon". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Ted M. Cannon

Enclosures
4652533:kc/121307

SPECIFICATION

TITLE: METHOD AND APPARATUS FOR DETERMINING A
PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT

RELATED APPLICATIONS

[01] This application claims the benefit of Provisional Application Serial No. 60/228,954, filed August 31, 2000, which is incorporated herein in its entirety.

FIELD OF THE INVENTION

[02] This invention relates generally to receiving applications for and processing of lending transactions. More specifically this invention provides a method and apparatus to assess the prepayment propensity of a borrower in the form of a prepayment "score" to enable assessment of (i) the value of mortgages, second mortgages, home equity loans or other debt instruments for investors, (ii) the value of credit card accounts and balance transfers, (iii) the value of term loans and leases, (iv) the behavior of brokers with respect to churning, (v) the valuation of existing portfolios, (vi) the risk management of institutions that hold debt instruments, and (vii) the pricing of mortgage portfolio servicing contracts.

BACKGROUND OF THE INVENTION

[03] By way of an introductory example, consider the most common of debt instruments, the consumer mortgage. The value of a mortgage depends, in large part, on the duration of the mortgage. At the inception of the mortgage there are broker

fees and various other settlement costs that are charged to the lender. When a mortgage extends for the term of many years, there is an opportunity for the lender to recoup costs of putting a mortgage in place for a given consumer and to make profit on that mortgage. This is particularly important for all business organizations that lend money, but it is particularly important for those mortgage financing organizations which have stockholders and other investors.

[04] When a mortgage loan is paid off early due to refinancing, depending upon how early in the term, the mortgage loan is paid off, there is the possibility that the lending institution can actually take a loss on the particular mortgage. The rate of prepayment depends on a number of objective factors. For example, during times of decreasing mortgage rates, on average, more consumers refinance their home loans than would otherwise occur, in order to obtain a lower monthly payment. However, for a given macroeconomic environment and other measurable, objective factors, each consumer evidences an individual propensity to prepay a loan. This prepayment propensity reflects the consumer's demographic and other objective attributes. A system that can assess such individual prepayment behavior by a consumer in advance of the loan will lead to more profitable loans being made, and hence the enhanced availability of funds for loans to more consumer-borrowers. The present invention therefore may be applied, without limitation, to a) the pricing of mortgages and other debt instruments, b) the valuation of existing portfolios of debt instruments, and c) the risk management of institutions that hold debt instruments.

[05] Additionally, the present invention is not limited to the type of debt instrument or lending transaction to which the prepayment score is useful. The invention includes,

but is not limited to, mortgages (consumer and commercial), second mortgages, refinanced mortgages, consumer loans, commercial loans, asset-backed loans, consumer leases, commercial leases, credit card accounts, credit card balance transfers, debt consolidation loans (term notes, etc.), mortgage-backed securities (i.e., mortgage pass through, CMO's, mortgage-backed bonds, principal-only, interest-only, etc.), and any servicing contract for these lending transactions that performs financially based on the quality (i.e., duration) of the cash flow.

[06] A further element of the present invention is the monitoring and scoring of brokers for these lending transactions. Mortgage brokers deal with both consumer-borrowers and lenders-clients. In order to generate brokerage fees, it is possible for a broker to encourage its consumer-borrowers to refinance their mortgages frequently and prematurely. When this occurs, the mortgage broker generates a fee for the broker, however, early prepayment of the prior mortgage instrument can result in a loss for the lender. Thus the present invention also has the capability to score mortgage broker prepayment behavior.

[07] The behavior of a broker is sometimes not all heinous. Sometimes a consumer, who is particularly attuned to the rise and fall of interest rates, will simply be the one who changes mortgage instruments more frequently than the average consumer. The broker who is scored based upon the prepayment behavior of the consumers that the broker brings to lenders, would like to know the pre-payment propensity for the given consumer. This would be useful so that the mortgage broker can optimize the broker's relationship with its lender-clients by only bringing consumer-borrowers who have a low prepayment propensity.

[08] Therefore, lenders and brokers badly need the ability to better measure prepayment behavior in advance of incurring marketing or underwriting charges; these expenses are too great to absorb blindly on behalf of consumers with poor prepayment propensities. Indeed, a beneficial use of the invention would be in managing the initial marketing effort itself. For example, only those customers who can be shown to score favorably for prepayment behavior might receive a solicitation for a mortgage product A. Consumers who are revealed to represent a substantial prepayment risk may be offered a more suitable mortgage product B, reflecting the increased risk. In this way, enhanced customers segmentation and product design initiatives converge to benefit consumers and their sources of debt financing, to the benefit of each.

[09] To understand the potential impact of national prepayment scoring standard, as manifested in the present invention, one need look no farther than the existing default risk scoring standard, owned and distributed by Fair, Isaac and Company, Inc. (Fair Isaac) for over 30 years. By establishing a standard methodology for scoring borrower default risk, and broadly disseminating it, Fair Isaac dramatically enhanced mortgage lender insight into expected loan dynamics. In finance, enhanced insight is synonymous with enhanced information. Enhanced information implies reduced risk for the lender. Finally, reduced lender risk profiles produce lower costs of capital. In other words, because Fair Isaac standardized successfully a fungible measurement of default risk, more money is available for consumers to borrow, at better and cheaper interest rates. The market is more efficient than before and everyone benefits.

[10] To further qualifying the timeliness of the invention, please refer to exhibit I, "Green Tree chief returns \$23 million..." The Wall Street Journal, March, 1998. This story highlights the industry wide uncertainty surrounding prepayment speeds in consumer debt portfolios. One industry leading company, Green Tree Financial, "has been hit hard the past year by escalating loan losses in the painful recognition that its accounting has been too aggressive. Also, an unexpected wave of loan prepayments hit the industry, as borrowers sought lower interest rates, indicating working-class consumers were not as unsophisticated as lenders had believed." Stated plainly, Green Tree overstated prior year earnings significantly, exercising its option under GAAP accounting to roll forward and capture in advance projected lending profits, even though those very profits were merely estimated based in part on arbitrary prepayment assumptions. In large measure because Green Tree badly miscalculated these prepayments speed assumptions, in 1997 the company was forced to charge off \$390 million of 1996 reported profit. In 1998 the company was sold off to Conseco.

[11] Earlier disclosures in the area of prepayment scoring in a lending context are limited or nonexistent. United States Patent No. 5,696,907, entitled "System and Method for Performing Risk and Credit Analysis of Financial Service Applications," issued to Tom. The Tom patent discloses using a neural network to mimic a loan officer's underwriting decision making. The method of the Tom patent is based on a non-iterative regression process that produces an approval criterion that is useful in preparing new or modified underwriting guidelines to increase profitability and minimize losses for a future portfolio of loans. A prepayment observation is used in the neural net as a negative flag, but no prepayment scoring system is utilized in the

Tom patent.

- [12] In view of the prior art, there is a clear need for measuring and predicting a consumer's prepayment propensity, as well as a clear and strong need for a method and apparatus to produce such a measuring and predictive parameter.

BRIEF SUMMARY OF THE INVENTION

- [13] The system and method of the present invention generally works in the following manner: the service bureau or broker will electronically capture individual loan applications from consumers. Those loan applications will be sent to lenders for evaluation. The lender, using the present invention submits the loan application for review and analysis. The loan application will be reviewed by the present invention according to a sophisticated economic and customer behavior model, which will score the prepayment behavior of candidate borrowers. The score for these borrowers, which is an index of their prepayment propensity, will be electronically returned to the lender. The lender will in turn use the prepayment score and calibrate an appropriate mortgage price including the setting of interest rates, fees, broker commissions, and potentially consumer rewards. Using this consumer scoring technique, a lending institution can seek to contact or contract with those consumers who display a low propensity to prepay.

- [14] The advanced scoring of customer prepayment propensities materially improves the lender's to risk profile as regards new lending customers. This novel insight adds value to the marketing, underwriting, lending, administrative process for first and second mortgages, credit card balance transfers, and asset-backed term loans such as

automobile loans. By assisting lenders in their efforts to segment customers according to this crucial behavior metric, waste and excess costs are driven from the lending economy. More money is thus available, more cheaply, for more people.

[15] To the borrower, this system offers several advantages. First, more favorable loan terms can be made to those consumers who exhibit a beneficial borrowing behavior, i.e., borrowers who are not likely to prepay their loans but instead maintain their loans for a profitable duration. Further, dealing with a stable borrower market results in a more favorable financial environment on for all lenders thereby mitigating the risk of loss and, in the normal course of all efficient markets, passing that financial advantage onto borrowers generally.

[16] Once again, the irrefutable economic relationship between financial risk-taking and expected financial reward informs the environment addressed by the present invention. If lenders reduce their risks-and by extension their costs-through enhanced prepayment scoring, ultimate borrowing costs paid by consumers will decline.

[17] For the loan originator, the system offers several advantages. The loan originator can more efficiently price the particular loan. Further the loan originator can more efficiently select brokers and intermediaries who will select the best borrowers. Further, the system and method of the present invention will lead to more efficient direct and indirect marketing investments by identifying individual consumers and groups of consumers who exhibit the most beneficial borrowing behavior, i.e., a propensity not to prepay financial obligations.

[18] Given that direct marketing costs are exploding as the conventional direct channels (e.g. mail and outbound telemarketing) become saturated, any available efficiency in the direct marketing process is highly desirable. For example, in the marketing of home equity lines of credit (i.e. second mortgages), direct-mail response rates are now, on average, running below 0.3% (i.e. below 3/10ths of one percent). Obviously, some fraction of even this small respondent sample will prove ill-suited, as regards prepayment behavior, for the debt product being marketed. Therefore, the tailoring of specific debt products to consumers of specific prepayment behavior characteristics is essential to the efficient pricing of debt instruments. Lead generation, third-party data acquisition, underwriting, yield spread calculations all directly inform debt instrument profitability, and are all beneficially affected by the present invention.

[19] Finally, in the context of sophisticated asset liability management (ALM), subtle prepayment behavior analysis provides significant benefits to its practitioners. Because ALM, as a primary objective, seeks to minimize destructive asymmetries in asset and liability cash flows, intelligent risk managers will utilize debt contracts of varying expected durations to strengthen their balance sheet. For example, a lender's risk manager may seek multiple classes of debt instrument, reflecting multiple prepayment profiles, in order to assure himself of adequate incoming cash flow to sustain his expected liability cash outflows. In the matching, therefore, of expected cash in- and out-flows, the prudent risk manager utilizes a carefully segmented portfolio of debt instruments scored by prepayment propensities (and other measures) and priced accordingly, to avert liquidity crises.

- [20] An additional, equally valuable use of the present invention is in the valuation of existing mortgage or debt instrument blocks of business. This valuation may be required by lender risk managers, auditors, regulators, or investors; it may reflect stakeholder interest in actively managing asset-liability risk, or it may be performed as part of the merger and acquisition appraisal. In all instances, the prepayment scoring system quantifies from a granular perspective upward to a pool, or block perspective, the prepayment speed characteristics of the debt instruments. As we have seen in the Green Tree case, failing to adequately price prepayment risk has enormous balance sheet implications, and typically leads one to grossly over value a portfolio or the enterprise itself.
- [21] For auditors, the system of the present invention offers a quantitative measure of prepayment risk thus reducing auditor exposure to "claw-back" write-downs. This situation occurs in the case of issuers that secure these mortgages and, under the generally applied accounting procedures (GAAP) accelerate and capture earnings based on certain prepayment assumptions. If those prepayment assumptions are incorrect, prior year financial statements are incorrect and massive charges are required to reflect lower portfolio earnings.
- [22] For banking regulators, the system of the present invention offers the ability to quantify balance sheet risk resulting from expected consumer prepayment behavior. This will allow regulators to more precisely measure and assign minimum bank capital levels.
- [23] For credit rating agencies, the ability to score according to an objective, standard

methodology prepayment risk provides enormous assistance in rating a lender's creditworthiness. Rating agencies function, effectively, as credit market bellweathers. Lending institutions are dependent on favorable credit ratings in order to float their institutional debt at advantageous rates; rating agencies, as in the case of regulators, evaluate carefully lenders' claims of capital adequacy; the capital (cash reserves) retained by lenders is directly and immediately affected by debt instrument prepayment speeds. This is because, under GAAP accounting rules, lenders are allowed to capture a substantial percentage of the future expected profits for a given contracted debt instrument, and those profits are themselves substantially dependent on the assumed life of the instrument. (In the case of subprime mortgages, for example, profits may double if the mortgage is maintained in force for four years instead of three). If those profits are overstated, they must be reversed, with resultant charges reducing lender capital (capital: paid-in cash investments plus retained profits). Therefore, rating agencies must scrutinize lender portfolio prepayment speed assumptions, because if those assumptions prove false, then the lender will suffer a reduction in capital. Any significant impairment of lender capital necessarily suggests a reduction in its credit rating. Credit rating agencies will be major beneficiaries and users of the present invention.

- [24] For investment bankers, the system of present invention establishes a standardized prepayment methodology that allows merger and acquisition advisers to be able to quantitatively measure the balance sheet risk in a target banking or mortgage company. In addition, investment bank usage of the present invention will include its application to debt instrument securitization. Securitization describes the process

by which pools of mortgage or other debt instruments are purchased by investment banks-in their capacity as underwriters-and re-sold to institutional and public investors as reconstituted securities. Typically, these securitizations benefit originators of debt, because they realize significant acceleration in realized profits; they also significantly diversify their risks by selling significant aspects of the debt instrument to asset underwriters and others. However, the typical debt instrument securitization proceeds with the originating lender retaining significant prepayment risk; if prepayment speeds accelerate beyond levels assumed in the securitization pricing process, the originating lender is held responsible. Hence the invention, by measuring the expected prepayment behavior and scoring in according to an accepted, industry standard method, will improve the securitization process and render it more efficient. Once again, this will reduce costs for all participants and free up more capital for lower-cost consumer borrowing.

[25] For investors, the method of the present invention provides a way to make investment decisions based upon quantified debt instrument prepayment behavior risk for lending institutions in which investors might want to invest, or to evaluate the relative stability of mortgage securities that are backed by individual debt instruments.

[26] These and other advantages of the present invention are described in reference to the specification that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[27] **Figure 1** is an overview of the process of the present invention.

- [28] **Figure 2** is a block diagram of the present invention.
- [29] **Figure 3** is a block diagram showing the user interface module connections.
- [30] **Figure 4** is block diagram showing the interactions with the prepayment historical data.
- [31] **Figure 5** is a block diagram showing the interactions with the econometric model.
- [32] **Figure 6** is a block diagram showing the factors that are used by the user interface module.

DETAILED DESCRIPTION OF THE INVENTION

- [33] Referring to **Figure 1**, an overview of the process of the present invention is shown. The mortgage broker or lending institution first obtains a loan application from a borrower **10**. That information is electronically transmitted to the present invention, which parses the information **12** of the loan application into various categories that are relevant to the scoring of the potential loan. The loan application contents are parsed based upon the information needs of a sophisticated, mathematical model resident in the present invention. A prepayment score is then derived **14** for the particular consumer as a function of the particular loan type being requested, and in further view of the interest rate environment in which the loan is being processed (i.e. rising or falling interest rates). As previously noted this score is an indication of the prepayment propensity of a particular consumer. The prepayment score is then returned to the lender **16**. Thereafter the lender can create a customized loan product that rewards favorable prepayment behavior of the

consumer 18.

[34] Referring to **Figure 2**, an overview of the system of the present invention is shown. A loan originator **20** receives the application from a potential consumer. That application is then input to the loan originator's data delivery channels **22**. Such data delivery channels **22** are (without limitation) e-mail, fax, Internet, and generally other electronic means. Other loan originators **34** also send their respective consumer applications over their own data delivery channels **36**.

[35] The present invention anticipates delivery of loan applications **24** over the Internet **28** or other digital electronic means such as wireless communications methods as well. Electronic loan applications **40** enter the system of the present invention through a communication server **42**. The loan information concerning a given consumer is then submitted to an application parser **52**. Application parser **52** divides the information into loan information **58** and applicant information **56**. Loan information **58** is information that relates to the amount, the term, down payment, loan type, and other information important and relating to the amount of money to be loaned. Applicant information **56** is information such as name, address, Social Security number, and other demographic information concerning the applicant.

[36] Loan information **56** is fed into a prepayment model library database **66**. The prepayment model library database **66** comprises information concerning prepayment historical data **62**. The results are fed into model training server **64** which processes prepayment historical data **62** of both an individual and demographic groups which in turn provides updates to the model library database **66**.

Once loan information 58 is processed by the prepayment model library database 66 an analytical prepayment model 60, which is based upon the loan information 58 is provided to the prepayment calculation server 46. Prepayment calculation server 46 receives additional information from econometric model 48 which establishes the relationship among the wide variety of variables. Econometric model 48 generates interest rate, mortgage rate and other economic parameters that, arrayed in time series, comprise scenarios utilized by the prepayment calculations server. These scenarios are generated from the Low Discrepancy Sequence (LDS) logic, rather than using random number generation. The LDS logic affords significantly higher model accuracy with the same number of scenarios.

[37] Once a prepayment score 44 is derived by prepayment calculation server 46, prepayment score 44 is sent to the communication server 42 and is transmitted over the Internet (or other electronic channels) 28 through the data delivery channels 22 or 36 back to loan originators 20 or 34 who can then either approve, disapprove, or create customized loan product for the consumer.

[38] Prepayment score 38 is calculated based upon the following model. The specific prepayment analysis of the present invention is conceptually shown below.

[39] The following variables:

[40] $A = (a_1, a_2, \dots, a_n)$

[41] $L = (l_1, l_2, \dots, l_m)$

[42] are vectors of the applicant's data and loan parameters.

[43] $E_s(t) = (e_{1s}(t), e_{2s}(t), \dots, e_{k_s}(t)); \quad s = 1, \dots, S$

[44] denotes a set of Low Discrepancy Sequence (LDS)-based scenarios of the econometric parameters, which have been generated by the RTH Linked Index Econometric Model. Thus the model is a set of stochastic differential equations that describe the dynamics and interaction of major macroeconomic indicators, each relevant to the prepayment propensity calculation.

[45] Analytical Prepayment Model \mathfrak{R} , which varies with the types of loan applied for, is trained to calculate prepayment value p_s in a given scenario based on the applicant's data (A), loan parameters (L), and econometric parameters (E):

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

[46] Total prepayment, accumulated by the time T in scenario s , can be calculated as:

$$P_s(T) = \prod_i p_s(t_i)$$

[47] Then, total prepayment at time T is given by:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

[48] Finally, the prepayment score is:

$$Score = \sum_T TP(T)$$

[49] The analytical model that produces the prepayment score may be further informed

by additional external behavioral or econometric factors, based on subsequent research, as well as the aforementioned behavioral scoring of mortgage broker behavior.

[50] The present invention may also be represented in an alternative embodiment in the form of the credit engineering workstation (CEW). This CEW (more fully described below) comprises a user interface which allows a loan originator to conduct all of the prepayment calculations, model analysis, and pricing of the present invention using the prepayment model first noted above.

[51] The CEW operates in either a Unix or Windows NT environment using Oracle, SQL server, Sybase, DB2, or Informix database support. The CEW also uses CORBA or, structured object models together with a JAVA/HTML browser based graphical user interface.

[52] The subroutines of the CEW all contribute to the end goal of determining the prepayment propensity of a consumer. For example, subroutines of the present invention deal supports the generation of various interest rate scenarios, and subsequent economic scenarios model fitting processes that fit the modeled interest rates scenarios to historical and current interest rate yield curve performance as well as to other macro economic indicators.

[53] Part of the system includes rewards pricing logic to efficiently measure and price the impact of rewards on consumer prepayment behavior. For example it would be most beneficial to a lender to reward the consumer for not prepaying the lender's loan. Such a reward could be assessed in terms of its impact on the consumer

prepayment behavior. The system therefore permits the end-user to design pro forma rewards structures and to test their impact on prospective consumer prepayment behavior.

[54] Various user definable screens also establish default spreads, prepayment spreads, broker commission schedules, and other financial factors that influence the pricing of the product to be offered to the consumer. Various other economic scenarios are collected via the user interface and combined with various probabilities and default data as well as other lender defined criteria result in rationally priced end-user mortgage contracts.

[55] Referring to **Figure 3**, further information concerning the CEW of the present invention shown. The system comprises user interface module **70** which is the basic graphical user interface and other software that allows an originator to provide information concerning a consumer who wishes to borrow money from lender. The user interface module allows the collection of loan attributes **76**, applicant attributes **74**, and reward program attributes **72**. In addition user interface module **70** collects or calculates spreads, broker commissions and other costs associated with the loan **78**. Loan attributes **76** and other loan related costs are fed into pricing engine **84** which, with other information, assists in creating an appropriate loan price **86**.

[56] Loan attributes **76**, applicant attributes **74**, and reward program attributes **72** all which have an impact on the value of the loan are fed into prepayment calculation server **80**. Prepayment calculation server **80** receives input from the various prepayment model parameters and creates prepayment score **82**.

[57] Referring to **Figure 4**, a block diagram showing the interactions which are necessary to create a prepayment model are shown. Consumer information **96** which consists of applicant attributes **74** and loan attributes **76** are fed into a prepayment model fitting **92** module. Prepayment model fitting **92** establishes various prepayment model parameters **94** based upon prepayment historical data **90**. Once the appropriate prepayment model is created by prepayment model fitting **92**, a model is returned to the prepayment calculation server for the calculation of the prepayment score of the particular consumer given the type of loan to consumer is requesting. The prepayment calculation server also benefits from input from an econometric model scenario generator.

[58] Referring to **Figure 5**, the interactions for the econometric model are shown. Econometric model scenario generator **106** receives input from econometric model fitting module **104** and LDS scenarios **108**. Econometric model fitting module **104** receives information from econometric historical data **100** and current market environment **102** which comprises, without limitation, information concerning rising or falling interest rates and trends. The information from econometric historical data **100** concerns the demographic group to which the consumer belongs and other econometric information such as age, income, credit rating, occupation and other factors. The information from current market environment **102** concerns the direction and velocity of changes to interest rates. Econometric model scenario generator **106** processes the information and produces various scenarios based on the information.

[59] Referring again to **Figure 3**, prepayment calculation server **80** creates prepayment score **44** for the particular consumer in question. Prepayment score **44** is based upon

the established prepayment model and the generated econometric model.

Prepayment score **44** is transmitted to the pricing engine **82** to establish the pricing of the loan product to be offered to the consumer in question.

[60] Referring to **Figure 6**, additional parameters which the user interface module uses to create the various scenarios are shown. Additional aspects of the present invention provide for creation of new products. Strategy optimizer **122** is based upon acceptance of offered products by consumers and input from and relating to other products are on the market. Strategy optimizer **122** generates marketing plans based upon individual lenders' portfolios. Such a market plan could assist the lender in offering new products to the marketplace that are more profitable for the lender. The system includes targeting optimizer **124** which provides a way to offer loan products to those consumers having the most favorable prepayment characteristics, i.e., a low propensity to prepay loans made. The system also comprises loyalty optimizer **126** which models and defines offers and other inducements to consumers to reward financially advantageous consumer behavior. Channel optimizer **128** is part of the present invention. Channel optimizer **128** analyzes the channels of delivery of financial product offerings to evaluate and determine the channel that is the most efficient way to deliver various financial products. The system also comprises database optimizer **130** which receives and organizes information in the various databases to constantly build and refined prepayment historical data **90** and econometric historical data **100**.

[61] The target platform on which the system of the present invention will run is either an Intel Pentium processor based system with typically 32 megabytes of RAM, hard

disk storage and retrieval, and communications capability using the TCP/IP protocol. Alternatively the system will also run under the UNIX operating system on a Sun Solaris platform. In both cases displays for users are anticipated as is the ability to output hard copy reports. In typical operation, a plurality of users, remote from the system site will access the system via private networks or over the Internet to send the information necessary for the present invention to make the desired calculations leading to the prepayment score. This score is then sent back to the requesting user at the remote terminal.

[62] Although described herein with respect to a mortgage loan or loan, the present invention is applicable to numerous financial instruments that have a value that depends on the particular consumer's actions over time. The value of typical debt instruments, such as, but not limited to, mortgages, second mortgages, home equity loans, car loans, school loans, term loans, leases, credit card accounts, and credit card balance transfers, depend on a continued stream of cash and are therefore affected significantly by prepayment.

[63] The value of other instruments that depend on the cash stream over time, such as open-end car leases and whole-life insurance policies, can also depend on the consumer's actions, and therefore, for purposes of this invention can be considered as a form of debt instrument. In the car lease scenario, predicting the probability of a consumer electing to purchase or return the car before the end of the lease (prepay) is important in determining the value of the lease. Even a consumer's predisposition to keeping (purchasing at residual value price, a type of prepayment) or returning the car at the end of the lease can be used to modify the lease terms to the leasing entity's

advantage.

[64] Likewise, the likelihood of a consumer to cash out the surrender value of a whole-life insurance policy (another form of prepayment, albeit in the opposite direction, that ends the stream of cash) can significantly affect the ultimate value of the policy to the insurer.

[65] Known database and computer-based data mining techniques can be used for analyzing: the value of financial instruments (and portfolios in which they are packaged) based on the prepayment score associated with each of them; the risk associated with portfolios containing the financial instruments; and the pricing for servicing those portfolios. Additionally, instruments can be packaged together into portfolios based, at least in part, on the prepayment scores of the applicants.

[66] A system and method for prepayment score generation has been described. Those skilled in the art will appreciate that other variations of the present invention are possible without departing from the scope of the invention as described.

WHAT IS CLAIMED IS:

[c1] A system for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:

at least one debt instrument origination computer terminal for accepting and transmitting a debt instrument application of an individual applicant;

a computer network connected to the at least one debt instrument origination computer terminal for receiving the transmitted debt instrument application of the individual applicant;

a communication server connected to the computer network for receiving the transmitted debt instrument application of the individual applicant;

an application parser connected to the communications server for receiving the transmitted debt instrument application of the individual applicant from the communications server and parsing the information into debt instrument information and applicant information;

a prepayment model library database comprising debt instrument prepayment models connected to the application parser for receiving the debt instrument information and fitting the debt instrument information into the debt instrument prepayment models and for transmitting debt instrument prepayment models that match the debt instrument information; and

a prepayment calculation server comprising a prepayment score generation model connected to the prepayment model library database for receiving the debt instrument

prepayment models and calculating a prepayment score for the debt instrument application of the individual applicant based upon the debt instrument prepayment model and the prepayment score generation model, the prepayment calculation server being further adapted to transmit the prepayment score to at least one debt instrument origination computer terminal via the communications server and the computer network;

where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment; and

wherein the at least one debt instrument origination computer terminal is adapted to use the prepayment score to adjust terms of the debt instrument of the individual applicant.

[c2] The system for determining a prepayment score of claim [c1], where the prepayment model library database further comprises:

a model training server for creating the debt instrument prepayment models for the prepayment model library database; and

prepayment historical data storage means connected to the model training server, the prepayment historical data further comprises prepayment statistics regarding debt instruments of various types.

[c3] The system for determining a prepayment score of claim [c1], where the prepayment calculation server further comprises an econometric model that

generates Low Discrepancy Sequence (LDS)-based scenarios of econometric parameters for input to the prepayment calculation server.

- [c4] The system for determining a prepayment score of claim [c1], further comprising means adapted to calculate a total prepayment at time T from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

- [c5] The system for determining a prepayment score of claim [c4], further comprising means adapted to calculate the total prepayment, accumulated by time, in scenario s from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

- [c6] The system for determining a prepayment score of claim [c5], further comprising means adapted to calculate the prepayment value in a given scenario from the formula:

$$p_s(t) = \Re (A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \Re is an analytical prepayment model.

[c7] The system for determining a prepayment score of claim [c1], where the applicant is either an individual consumer or an individual household.

[c8] The system for determining a prepayment score of claim [c1], further comprising computer-based means for using data associated with the prepayment score of the applicant and terms of the debt instrument to determine a calculation selected from the group consisting of: a value of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c9] A method for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:

collecting debt instrument and applicant information at a debt instrument originator;

transmitting the debt instrument and applicant information over a network;

receiving the debt instrument and applicant information at a service bureau;

the service bureau calculating a prepayment score the individual applicant, where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment;

the service bureau returning the prepayment score over the network to the debt

instrument originator; and

the debt instrument originator using the prepayment score to customize a debt instrument product for the individual applicant.

[c10] The method for determining a prepayment score of claim [c9], where calculating a prepayment score for the applicant comprises parsing the information into debt instrument information and applicant information.

[c11] The method for determining a prepayment score of claim [c10], further comprising providing the applicant information to a prepayment model library database and the debt instrument information to a prepayment calculation server.

[c12] The method for determining a prepayment score of claim [c11], further comprising the prepayment model library determining the prepayment model that best applies to the debt instrument information and providing that prepayment model to the prepayment calculation server.

[c13] The method for determining a prepayment score of claim [c12], further comprising the prepayment calculation server receiving a prepayment model and an econometric model, where the prepayment calculation server further calculates a prepayment score for the applicant.

[c14] The method for determining a prepayment score of claim [c13], where the total prepayment at time T is calculated from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

[c15] The method for determining a prepayment score of claim [c14], where the total prepayment, accumulated by time, in scenario s is calculated from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

[c16] The method for determining a prepayment score of claim [c15], where the prepayment value in a given scenario is calculated from the formula:

$$p_s(t) = \Re(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \Re is an analytical prepayment model.

[c17] The method for determining a prepayment score of claim [c9], where the applicant is defined as an individual consumer or an individual household.

[c18] The method for determining a prepayment score of claim [c9], further comprising rating a broker based on prepayment scores of applicants that are clients of said broker.

[c19] The method for determining a prepayment score of claim [c9], further comprising using the prepayment score of the applicant and terms of the debt instrument to assist in determining a calculation selected from the group consisting of: a value

of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c20] The method for determining a prepayment score of claim [c9], further comprising packaging said debt instrument into a portfolio based, at least in part, on the prepayment score of the applicant.

Abstract of the Disclosure

A method and apparatus is disclosed for determining the prepayment propensity of individual borrowers. Early payment of debt instruments, such as loans and leases, can lead to losses being suffered by lenders. The present invention analyzes the demographics associated with a particular borrower to determine both the individual and group based prepayment propensity. The history of the borrower, the history of the borrower's demographic group, interest rate trends and other factors are then used to calculate a prepayment score that can be used by the lender to determine the propensity of a given borrower to prepay the instrument in question. The score of the individual borrower can be used to estimate the profitability of a debt instrument and allow the lender to make appropriate adjustments prior to issuing the instrument. The individual prepayment scores of a lender's or broker's clients can also be used to rate the lender or broker.

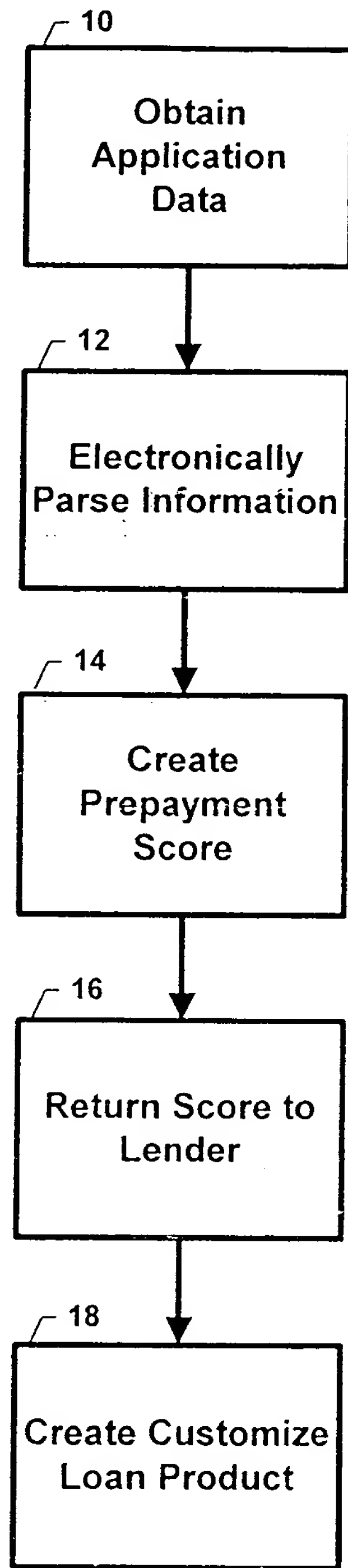


FIGURE 1

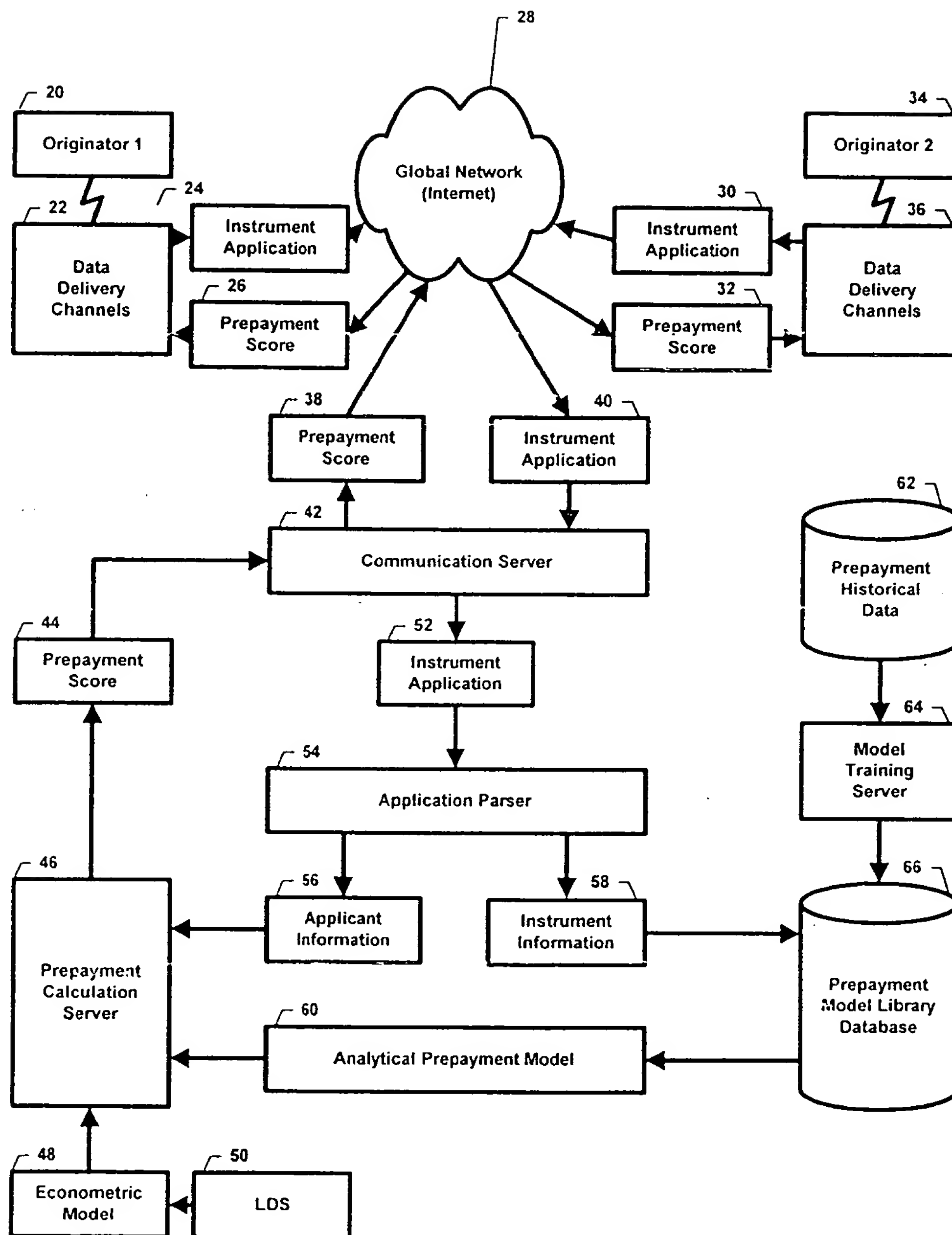


FIGURE 2

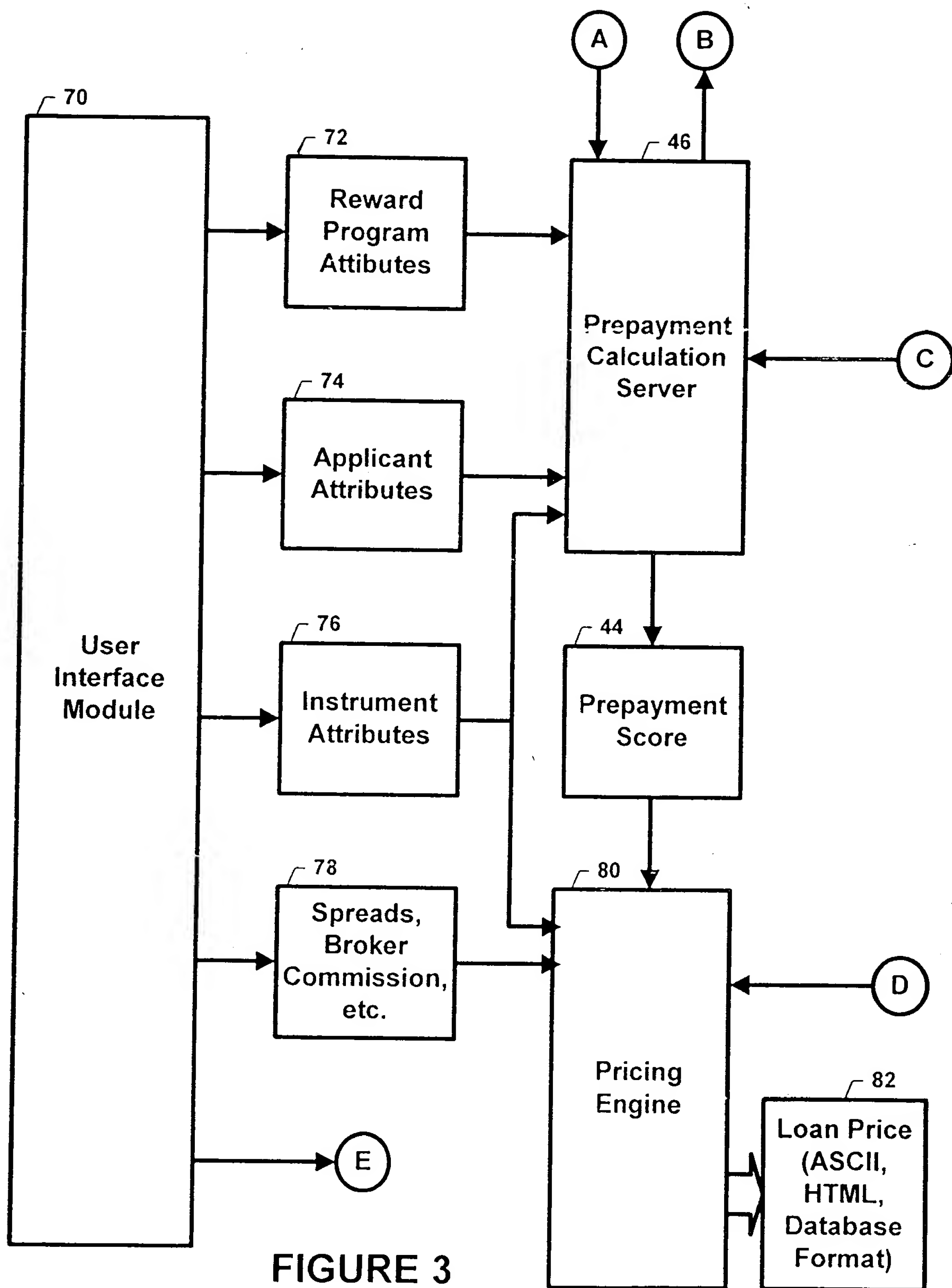


FIGURE 3

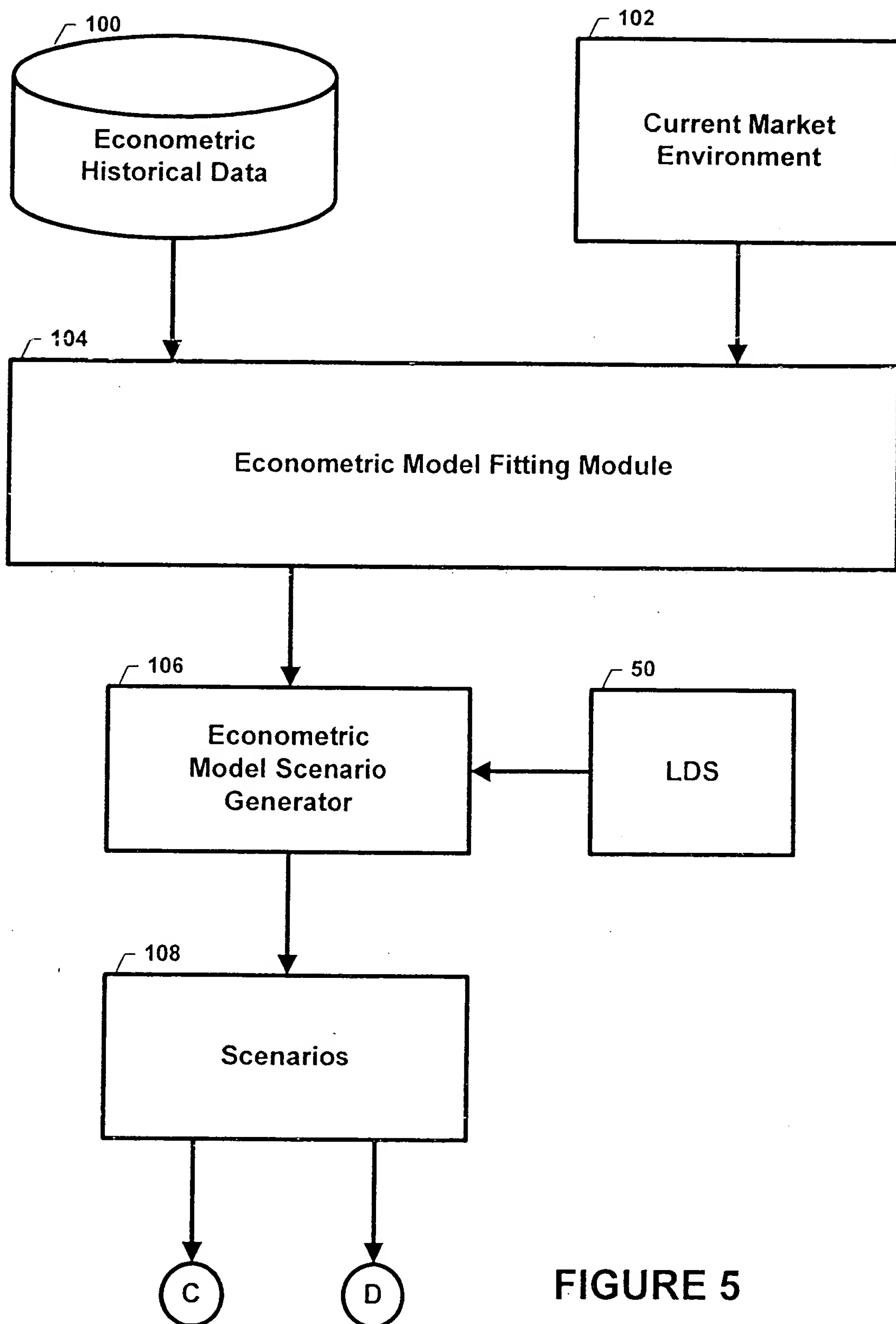


FIGURE 5

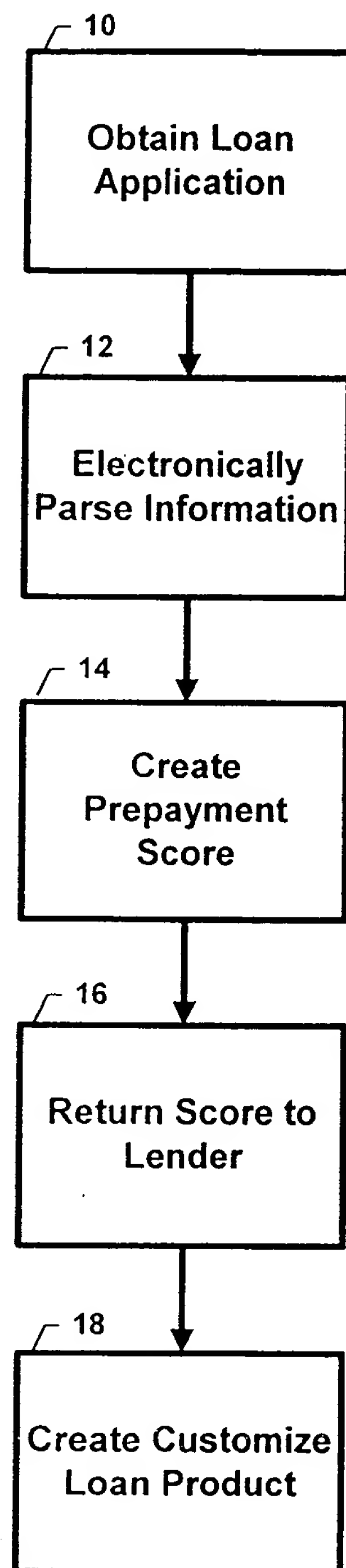


FIGURE 1

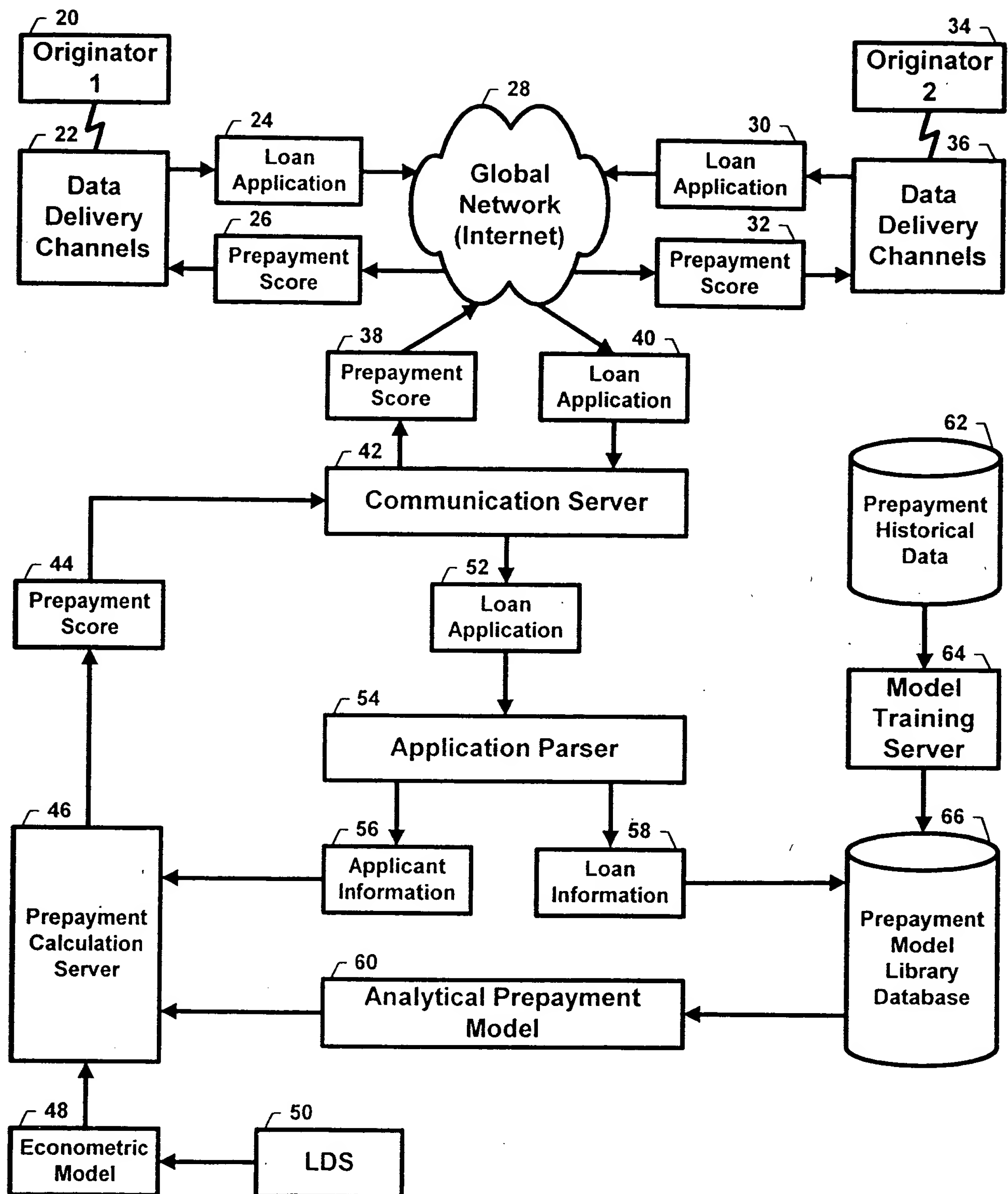


FIGURE 2

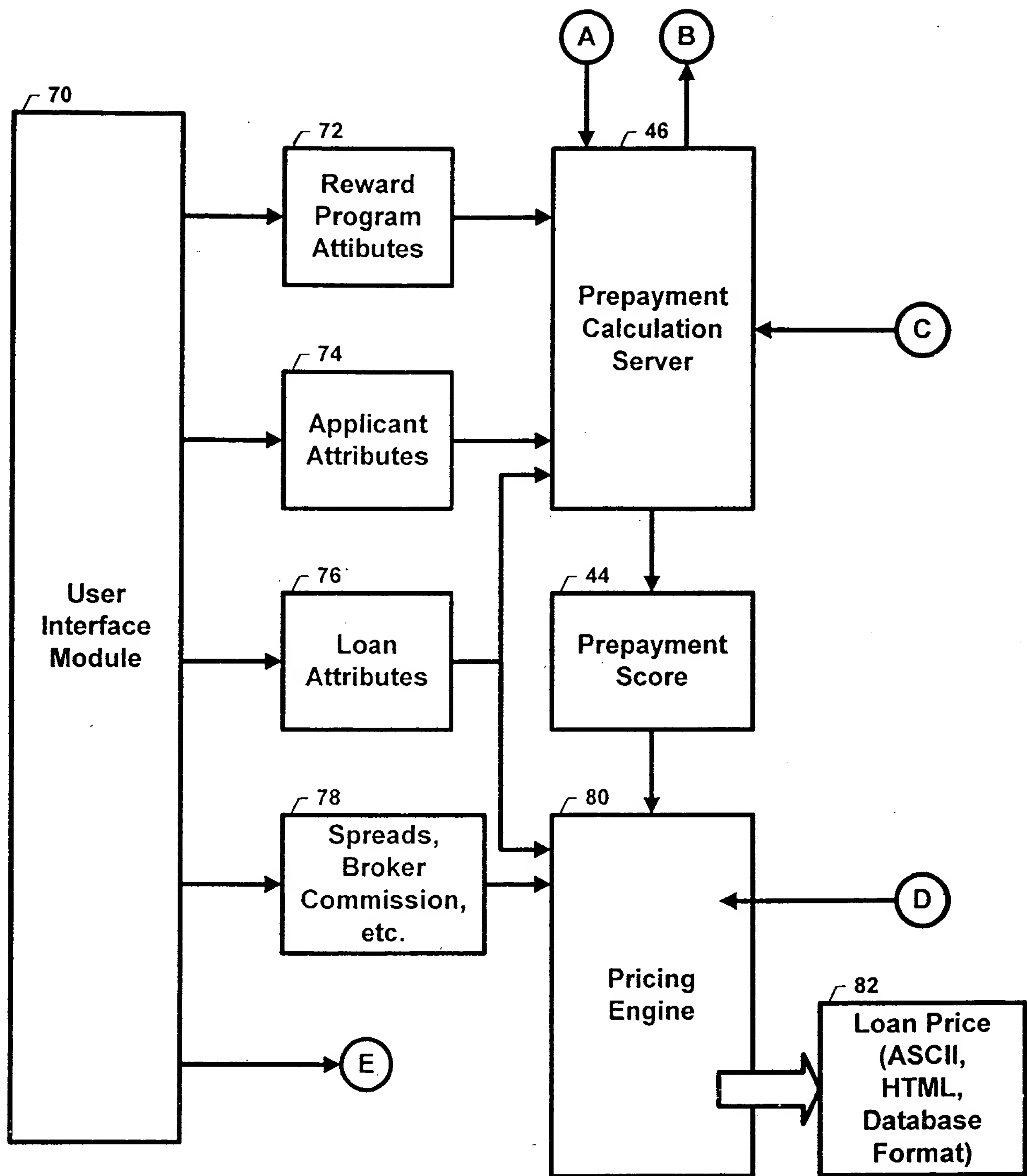


FIGURE 3

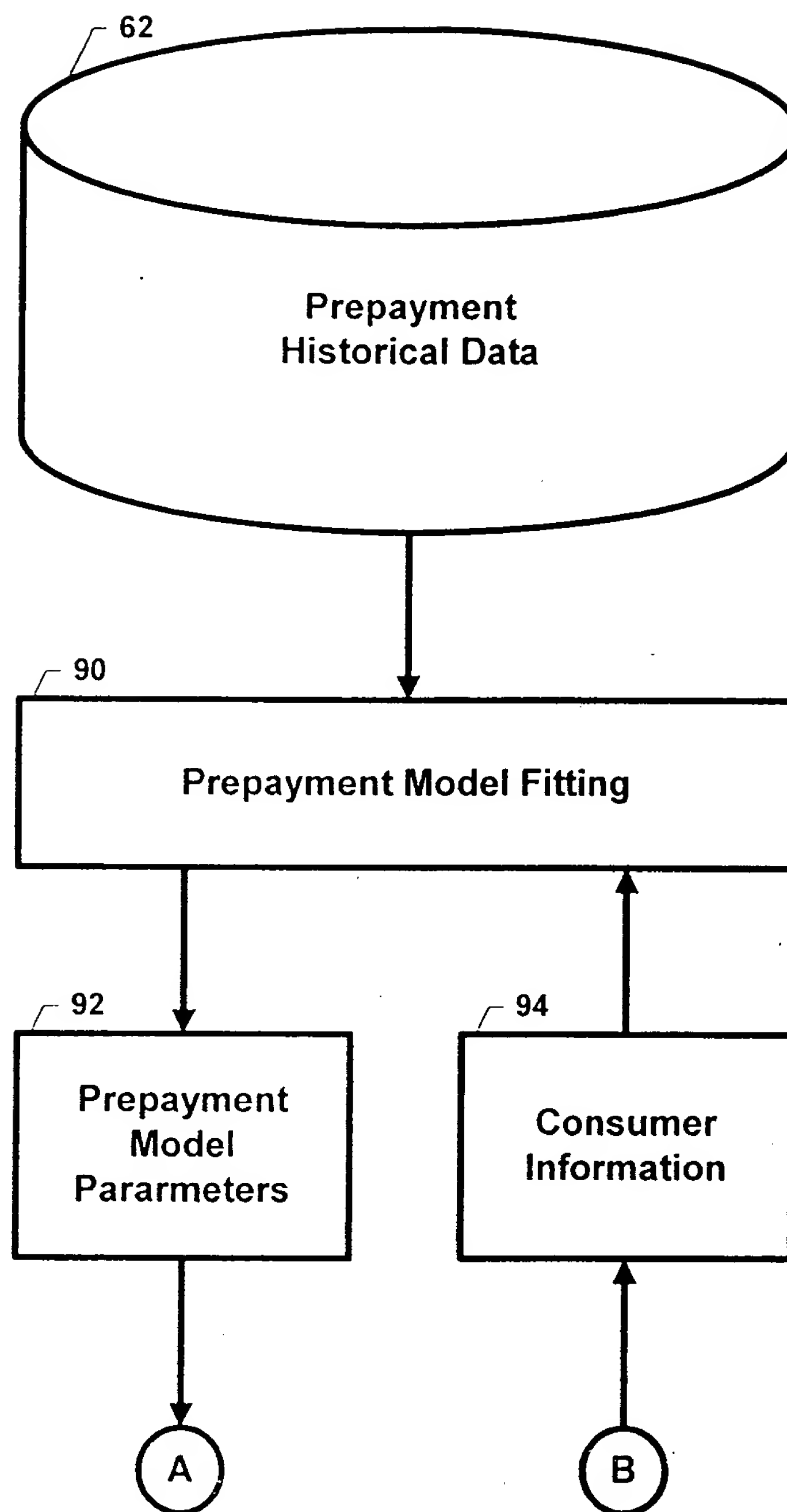


FIGURE 4

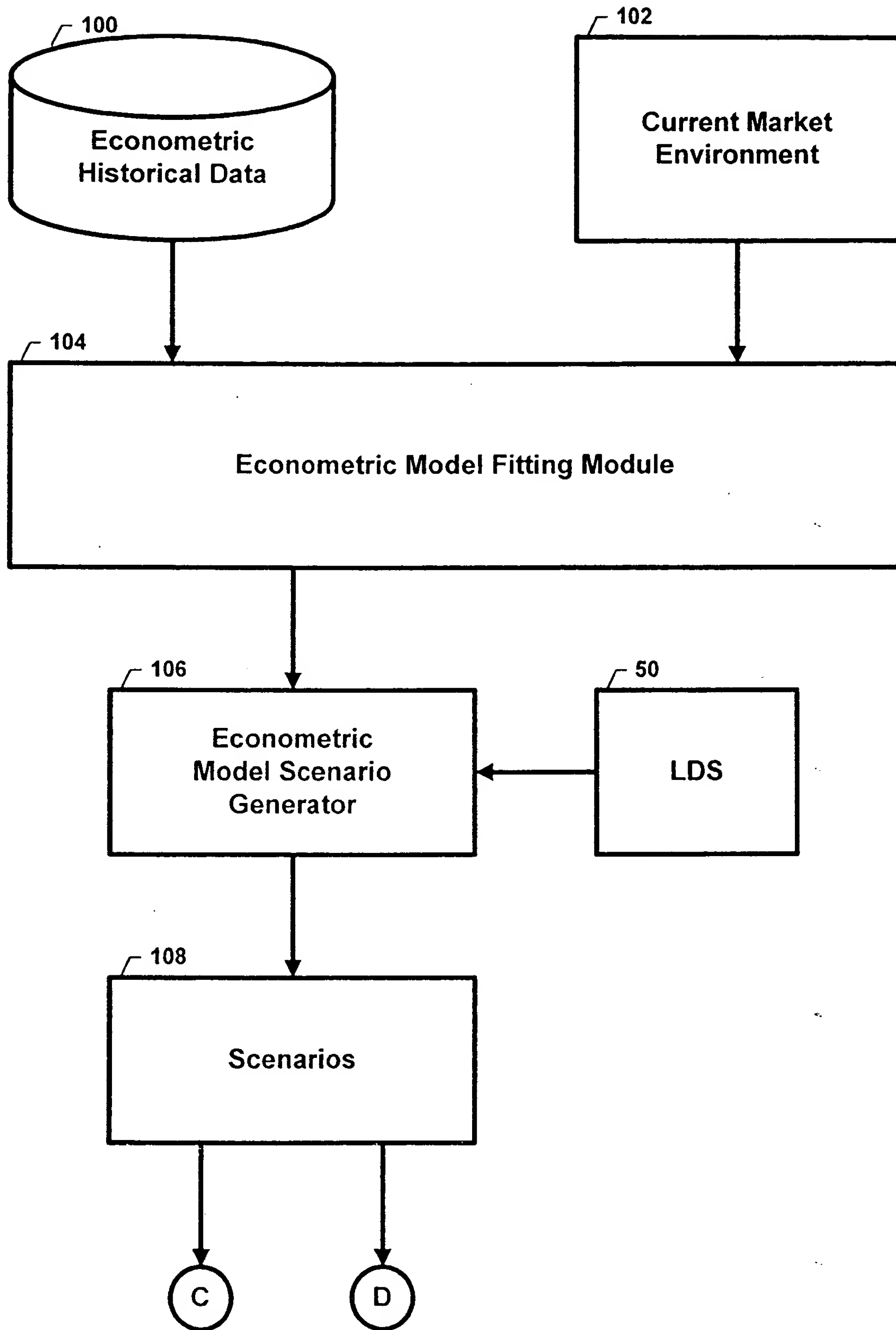


FIGURE 5

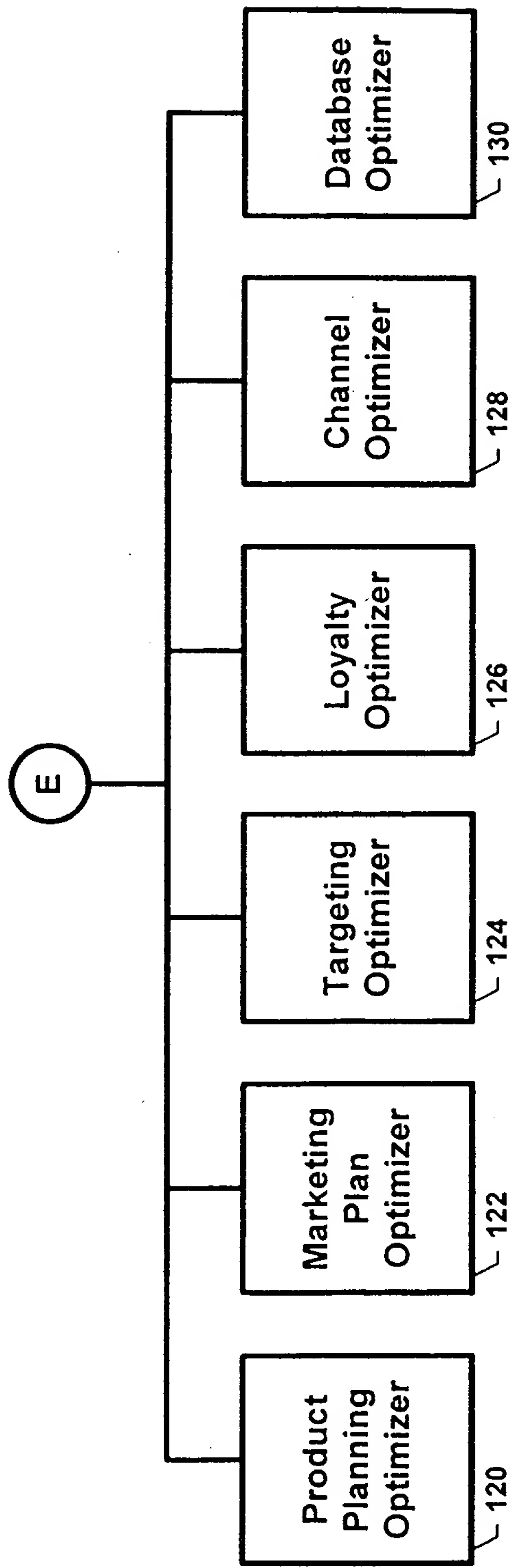


FIGURE 6

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Yuri Galperin, et al.
Appl. No.	:	09/942,983
PCT Filing Date	:	August 30, 2001
For	:	METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT
Examiner	:	Siegfried E. Chencinski
Group Art Unit	:	3692

STATEMENT OF CHARLES L. JONES III UNDER 37 C.F.R. § 1.48(a)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Charles L. Jones III, do declare as follows:

1. I am a citizen of the United States and reside at _____.
2. The above-referenced patent application was filed on August 30, 2001 listing Yuri Galperin, Vladimir Fishman and William A. Eginton as the joint inventors.
3. I believe that I, Charles L. Jones III, should also be named as an inventor in the above-referenced application.
4. The inventorship error occurred without deceptive intent on my part.

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or document, or any registration resulting therefrom.

Dated: _____

Charles L. Jones III

ASSIGNMENT

WHEREAS, I, Charles L. Jones III, residing at _____, am a joint inventor, along with Yuri Galperin, Vladimir Fishman, and William A. Eginton, of certain new and useful improvements in a METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT for which we have filed an application for Letters Patent in the United States, Application No. 09/942,983 Filed on August 30, 2001;

AND WHEREAS, MarketSwitch Corporation (hereinafter "ASSIGNEE"), a Delaware corporation, with its principal place of business at 2350 Corporate Park Drive, Suite 400, Herndon, VA 20171, desires to acquire the entire right, title, and interest in and to said improvements and said Application:

NOW, THEREFORE, in consideration of the sum of One Dollar (\$1.00) to me in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, I, said inventor, do hereby acknowledge that I have sold, assigned, transferred and set over, and by these presents do hereby sell, assign, transfer and set over, unto said ASSIGNEE, its successors, legal representatives and assigns, the entire right, title, and interest throughout the world in, to and under said improvements, and said application including all provisional applications relating thereto (including but not limited to U.S. Provisional Application No(s). 60/228,954, filed August 31, 2000 (respectively if plural applications)), and all divisions, renewals and continuations thereof, and all Letters Patent of the United States which may be granted thereon and all reissues and extensions thereof, and all rights of priority under International Conventions and applications for Letters Patent which may hereafter be filed for said improvements in any country or countries foreign to the United States, and all Letters Patent which may be granted for said improvements in any country or countries foreign to the United States and all extensions, renewals and reissues thereof; and I hereby authorize and request the Commissioner of Patents of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents on applications as aforesaid, to issue all Letters Patent for said improvements to said ASSIGNEE, its successors, legal representatives and assigns, in accordance with the terms of this instrument.

AND I DO HEREBY sell, assign, transfer, and convey to ASSIGNEE, its successors, legal representatives, and assigns all claims for damages and all remedies arising out of any violation of the rights assigned hereby that may have accrued prior to the date of assignment to ASSIGNEE, or may accrue hereafter, including, but not limited to, the right to sue for, collect, and retain damages for past infringements of said Letters Patent before or after issuance.

AND I HEREBY covenant and agree that I will communicate to said ASSIGNEE, its successors, legal representatives and assigns, any facts known to us respecting said improvements, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuing and reissue applications, make all rightful oaths and generally do everything possible to aid said ASSIGNEE, its successors, legal representatives and assigns, to obtain and enforce proper patent protection for said improvements in all countries.

IN TESTIMONY WHEREOF, I hereunto set my hand and seal this _____ day of _____, 20__.

Charles L. Jones III

STATE OF }
 } ss.
COUNTY OF }

On _____, before me, _____, notary public, personally appeared **Charles L. Jones III** personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged to me that he executed the same in his authorized capacity(ies), and that by his signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

[SEAL]

Notary Signature

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Second inventor: **Vladimir Fishman**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Third inventor: **William A. Eginton**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Fourth inventor: **Charles L. Jones III**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: _____

Mailing Address: same as above

Send Correspondence To:
KNOBBE, MARTENS, OLSON & BEAR, LLP
Customer No. 20,995

4093879:kc
080207

700% 0/00 0004 5806 4458

January 14, 2008

VIA CERTIFIED MAIL
No. 7006 0100 0004 5806 4533

Charles L. Jones
4570 Old Post Road
Charlestown, RI 02813-2560

Re: Patent Application for Prepayment Score
Application No. 09/942983
Our Reference: EXP.046A

Dear Mr. Jones:

As you know, a patent application for your invention entitled METHOD AND APPARATUS FOR DETERMINING LOAN PREPAYMENT SCORE was filed on May 15, 1998 and assigned Application No. 09/078,867, which is now issued Patent No. 6,185,543. You, Yuri Galperin, Vladimir Fishman and William A. Eginton were listed as inventors on this application. A later related application was filed on August 30, 2001 and assigned Serial No. 09/942,983, but did not include you as an inventor. It is our understanding that you were erroneously left off this application through no deceptive intent on your part.

Therefore, we are filing a Petition with the U.S. Patent Office to correct inventorship on the related application. In order to correct inventorship we need you to sign a declaration acknowledging that you and the other three inventors are the inventors of this application. In addition, you need to sign a Statement indicating that you were erroneously left off this application through no deceptive intent on your part ("Statement").

I have enclosed a copy of the application as filed (including the specification, drawings and claims), the Statement and an Assignment of the invention to Marketswitch. Please review the application to confirm that you should be added as an inventor.

Charles L. Jones

January 14, 2008

Page -2-

After your review, please sign and promptly return to me the Declaration, the Statement, and the Assignment in the pre-addressed envelope.

If you have any questions or if you would like to discuss this matter, please do not hesitate to contact me.

Sincerely

A handwritten signature in black ink, appearing to read "Ted M. Cannon". The signature is fluid and cursive, with a long horizontal stroke at the end.

Ted M. Cannon

Enclosures

4652533:kc/121307

SPECIFICATION

TITLE: METHOD AND APPARATUS FOR DETERMINING A
PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT

RELATED APPLICATIONS

[01] This application claims the benefit of Provisional Application Serial No. 60/228,954, filed August 31, 2000, which is incorporated herein in its entirety.

FIELD OF THE INVENTION

[02] This invention relates generally to receiving applications for and processing of lending transactions. More specifically this invention provides a method and apparatus to assess the prepayment propensity of a borrower in the form of a prepayment "score" to enable assessment of (i) the value of mortgages, second mortgages, home equity loans or other debt instruments for investors, (ii) the value of credit card accounts and balance transfers, (iii) the value of term loans and leases, (iv) the behavior of brokers with respect to churning, (v) the valuation of existing portfolios, (vi) the risk management of institutions that hold debt instruments, and (vii) the pricing of mortgage portfolio servicing contracts.

BACKGROUND OF THE INVENTION

[03] By way of an introductory example, consider the most common of debt instruments, the consumer mortgage. The value of a mortgage depends, in large part, on the duration of the mortgage. At the inception of the mortgage there are broker

fees and various other settlement costs that are charged to the lender. When a mortgage extends for the term of many years, there is an opportunity for the lender to recoup costs of putting a mortgage in place for a given consumer and to make profit on that mortgage. This is particularly important for all business organizations that lend money, but it is particularly important for those mortgage financing organizations which have stockholders and other investors.

[04] When a mortgage loan is paid off early due to refinancing, depending upon how early in the term, the mortgage loan is paid off, there is the possibility that the lending institution can actually take a loss on the particular mortgage. The rate of prepayment depends on a number of objective factors. For example, during times of decreasing mortgage rates, on average, more consumers refinance their home loans than would otherwise occur, in order to obtain a lower monthly payment. However, for a given macroeconomic environment and other measurable, objective factors, each consumer evidences an individual propensity to prepay a loan. This prepayment propensity reflects the consumer's demographic and other objective attributes. A system that can assess such individual prepayment behavior by a consumer in advance of the loan will lead to more profitable loans being made, and hence the enhanced availability of funds for loans to more consumer-borrowers. The present invention therefore may be applied, without limitation, to a) the pricing of mortgages and other debt instruments, b) the valuation of existing portfolios of debt instruments, and c) the risk management of institutions that hold debt instruments.

[05] Additionally, the present invention is not limited to the type of debt instrument or lending transaction to which the prepayment score is useful. The invention includes,

but is not limited to, mortgages (consumer and commercial), second mortgages, refinanced mortgages, consumer loans, commercial loans, asset-backed loans, consumer leases, commercial leases, credit card accounts, credit card balance transfers, debt consolidation loans (term notes, etc.), mortgage-backed securities (i.e., mortgage pass through, CMO's, mortgage-backed bonds, principal-only, interest-only, etc.), and any servicing contract for these lending transactions that performs financially based on the quality (i.e., duration) of the cash flow.

[06] A further element of the present invention is the monitoring and scoring of brokers for these lending transactions. Mortgage brokers deal with both consumer-borrowers and lenders-clients. In order to generate brokerage fees, it is possible for a broker to encourage its consumer-borrowers to refinance their mortgages frequently and prematurely. When this occurs, the mortgage broker generates a fee for the broker, however, early prepayment of the prior mortgage instrument can result in a loss for the lender. Thus the present invention also has the capability to score mortgage broker prepayment behavior.

[07] The behavior of a broker is sometimes not all heinous. Sometimes a consumer, who is particularly attuned to the rise and fall of interest rates, will simply be the one who changes mortgage instruments more frequently than the average consumer. The broker who is scored based upon the prepayment behavior of the consumers that the broker brings to lenders, would like to know the pre-payment propensity for the given consumer. This would be useful so that the mortgage broker can optimize the broker's relationship with its lender-clients by only bringing consumer-borrowers who have a low prepayment propensity.

[08] Therefore, lenders and brokers badly need the ability to better measure prepayment behavior in advance of incurring marketing or underwriting charges; these expenses are too great to absorb blindly on behalf of consumers with poor prepayment propensities. Indeed, a beneficial use of the invention would be in managing the initial marketing effort itself. For example, only those customers who can be shown to score favorably for prepayment behavior might receive a solicitation for a mortgage product A. Consumers who are revealed to represent a substantial prepayment risk may be offered a more suitable mortgage product B, reflecting the increased risk. In this way, enhanced customers segmentation and product design initiatives converge to benefit consumers and their sources of debt financing, to the benefit of each.

[09] To understand the potential impact of national prepayment scoring standard, as manifested in the present invention, one need look no farther than the existing default risk scoring standard, owned and distributed by Fair, Isaac and Company, Inc. (Fair Isaac) for over 30 years. By establishing a standard methodology for scoring borrower default risk, and broadly disseminating it, Fair Isaac dramatically enhanced mortgage lender insight into expected loan dynamics. In finance, enhanced insight is synonymous with enhanced information. Enhanced information implies reduced risk for the lender. Finally, reduced lender risk profiles produce lower costs of capital. In other words, because Fair Isaac standardized successfully a fungible measurement of default risk, more money is available for consumers to borrow, at better and cheaper interest rates. The market is more efficient than before and everyone benefits.

[10] To further qualifying the timeliness of the invention, please refer to exhibit 1, "Green Tree chief returns \$23 million..." The Wall Street Journal, March, 1998. This story highlights the industry wide uncertainty surrounding prepayment speeds in consumer debt portfolios. One industry leading company, Green Tree Financial, "has been hit hard the past year by escalating loan losses in the painful recognition that its accounting has been too aggressive. Also, an unexpected wave of loan prepayments hit the industry, as borrowers sought lower interest rates, indicating working-class consumers were not as unsophisticated as lenders had believed." Stated plainly, Green Tree overstated prior year earnings significantly, exercising its option under GAAP accounting to roll forward and capture in advance projected lending profits, even though those very profits were merely estimated based in part on arbitrary prepayment assumptions. In large measure because Green Tree badly miscalculated these prepayments speed assumptions, in 1997 the company was forced to charge off \$390 million of 1996 reported profit. In 1998 the company was sold off to Conseco.

[11] Earlier disclosures in the area of prepayment scoring in a lending context are limited or nonexistent. United States Patent No. 5,696,907, entitled "System and Method for Performing Risk and Credit Analysis of Financial Service Applications," issued to Tom. The Tom patent discloses using a neural network to mimic a loan officer's underwriting decision making. The method of the Tom patent is based on a non-iterative regression process that produces an approval criterion that is useful in preparing new or modified underwriting guidelines to increase profitability and minimize losses for a future portfolio of loans. A prepayment observation is used in the neural net as a negative flag, but no prepayment scoring system is utilized in the

Tom patent.

- [12] In view of the prior art, there is a clear need for measuring and predicting a consumer's prepayment propensity, as well as a clear and strong need for a method and apparatus to produce such a measuring and predictive parameter.

BRIEF SUMMARY OF THE INVENTION

- [13] The system and method of the present invention generally works in the following manner: the service bureau or broker will electronically capture individual loan applications from consumers. Those loan applications will be sent to lenders for evaluation. The lender, using the present invention submits the loan application for review and analysis. The loan application will be reviewed by the present invention according to a sophisticated economic and customer behavior model, which will score the prepayment behavior of candidate borrowers. The score for these borrowers, which is an index of their prepayment propensity, will be electronically returned to the lender. The lender will in turn use the prepayment score and calibrate an appropriate mortgage price including the setting of interest rates, fees, broker commissions, and potentially consumer rewards. Using this consumer scoring technique, a lending institution can seek to contact or contract with those consumers who display a low propensity to prepay.

- [14] The advanced scoring of customer prepayment propensities materially improves the lender's to risk profile as regards new lending customers. This novel insight adds value to the marketing, underwriting, lending, administrative process for first and second mortgages, credit card balance transfers, and asset-backed term loans such as

automobile loans. By assisting lenders in their efforts to segment customers according to this crucial behavior metric, waste and excess costs are driven from the lending economy. More money is thus available, more cheaply, for more people.

[15] To the borrower, this system offers several advantages. First, more favorable loan terms can be made to those consumers who exhibit a beneficial borrowing behavior, i.e., borrowers who are not likely to prepay their loans but instead maintain their loans for a profitable duration. Further, dealing with a stable borrower market results in a more favorable financial environment on for all lenders thereby mitigating the risk of loss and, in the normal course of all efficient markets, passing that financial advantage onto borrowers generally.

[16] Once again, the irrefutable economic relationship between financial risk-taking and expected financial reward informs the environment addressed by the present invention. If lenders reduce their risks-and by extension their costs-through enhanced prepayment scoring, ultimate borrowing costs paid by consumers will decline.

[17] For the loan originator, the system offers several advantages. The loan originator can more efficiently price the particular loan. Further the loan originator can more efficiently select brokers and intermediaries who will select the best borrowers. Further, the system and method of the present invention will lead to more efficient direct and indirect marketing investments by identifying individual consumers and groups of consumers who exhibit the most beneficial borrowing behavior, i.e., a propensity not to prepay financial obligations.

[18] Given that direct marketing costs are exploding as the conventional direct channels (e.g. mail and outbound telemarketing) become saturated, any available efficiency in the direct marketing process is highly desirable. For example, in the marketing of home equity lines of credit (i.e. second mortgages), direct-mail response rates are now, on average, running below 0.3% (i.e. below 3/10ths of one percent). Obviously, some fraction of even this small respondent sample will prove ill-suited, as regards prepayment behavior, for the debt product being marketed. Therefore, the tailoring of specific debt products to consumers of specific prepayment behavior characteristics is essential to the efficient pricing of debt instruments. Lead generation, third-party data acquisition, underwriting, yield spread calculations all directly inform debt instrument profitability, and are all beneficially affected by the present invention.

[19] Finally, in the context of sophisticated asset liability management (ALM), subtle prepayment behavior analysis provides significant benefits to its practitioners. Because ALM, as a primary objective, seeks to minimize destructive asymmetries in asset and liability cash flows, intelligent risk managers will utilize debt contracts of varying expected durations to strengthen their balance sheet. For example, a lender's risk manager may seek multiple classes of debt instrument, reflecting multiple prepayment profiles, in order to assure himself of adequate incoming cash flow to sustain his expected liability cash outflows. In the matching, therefore, of expected cash in- and out-flows, the prudent risk manager utilizes a carefully segmented portfolio of debt instruments scored by prepayment propensities (and other measures) and priced accordingly, to avert liquidity crises.

[20] An additional, equally valuable use of the present invention is in the valuation of existing mortgage or debt instrument blocks of business. This valuation may be required by lender risk managers, auditors, regulators, or investors; it may reflect stakeholder interest in actively managing asset-liability risk, or it may be performed as part of the merger and acquisition appraisal. In all instances, the prepayment scoring system quantifies from a granular perspective upward to a pool, or block perspective, the prepayment speed characteristics of the debt instruments. As we have seen in the Green Tree case, failing to adequately price prepayment risk has enormous balance sheet implications, and typically leads one to grossly over value a portfolio or the enterprise itself.

[21] For auditors, the system of the present invention offers a quantitative measure of prepayment risk thus reducing auditor exposure to "claw-back" write-downs. This situation occurs in the case of issuers that secure these mortgages and, under the generally applied accounting procedures (GAAP) accelerate and capture earnings based on certain prepayment assumptions. If those prepayment assumptions are incorrect, prior year financial statements are incorrect and massive charges are required to reflect lower portfolio earnings.

[22] For banking regulators, the system of the present invention offers the ability to quantify balance sheet risk resulting from expected consumer prepayment behavior. This will allow regulators to more precisely measure and assign minimum bank capital levels.

[23] For credit rating agencies, the ability to score according to an objective, standard

methodology prepayment risk provides enormous assistance in rating a lender's creditworthiness. Rating agencies function, effectively, as credit market bellweathers. Lending institutions are dependent on favorable credit ratings in order to float their institutional debt at advantageous rates; rating agencies, as in the case of regulators, evaluate carefully lenders' claims of capital adequacy; the capital (cash reserves) retained by lenders is directly and immediately affected by debt instrument prepayment speeds. This is because, under GAAP accounting rules, lenders are allowed to capture a substantial percentage of the future expected profits for a given contracted debt instrument, and those profits are themselves substantially dependent on the assumed life of the instrument. (In the case of subprime mortgages, for example, profits may double if the mortgage is maintained in force for four years instead of three). If those profits are overstated, they must be reversed, with resultant charges reducing lender capital (capital: paid-in cash investments plus retained profits). Therefore, rating agencies must scrutinize lender portfolio prepayment speed assumptions, because if those assumptions prove false, then the lender will suffer a reduction in capital. Any significant impairment of lender capital necessarily suggests a reduction in its credit rating. Credit rating agencies will be major beneficiaries and users of the present invention.

- [24] For investment bankers, the system of present invention establishes a standardized prepayment methodology that allows merger and acquisition advisers to be able to quantitatively measure the balance sheet risk in a target banking or mortgage company. In addition, investment bank usage of the present invention will include its application to debt instrument securitization. Securitization describes the process

by which pools of mortgage or other debt instruments are purchased by investment banks-in their capacity as underwriters-and re-sold to institutional and public investors as reconstituted securities. Typically, these securitizations benefit originators of debt, because they realize significant acceleration in realized profits; they also significantly diversify their risks by selling significant aspects of the debt instrument to asset underwriters and others. However, the typical debt instrument securitization proceeds with the originating lender retaining significant prepayment risk; if prepayment speeds accelerate beyond levels assumed in the securitization pricing process, the originating lender is held responsible. Hence the invention, by measuring the expected prepayment behavior and scoring in according to an accepted, industry standard method, will improve the securitization process and render it more efficient. Once again, this will reduce costs for all participants and free up more capital for lower-cost consumer borrowing.

[25] For investors, the method of the present invention provides a way to make investment decisions based upon quantified debt instrument prepayment behavior risk for lending institutions in which investors might want to invest, or to evaluate the relative stability of mortgage securities that are backed by individual debt instruments.

[26] These and other advantages of the present invention are described in reference to the specification that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[27] **Figure 1** is an overview of the process of the present invention.

- [28] **Figure 2** is a block diagram of the present invention.
- [29] **Figure 3** is a block diagram showing the user interface module connections.
- [30] **Figure 4** is block diagram showing the interactions with the prepayment historical data.
- [31] **Figure 5** is a block diagram showing the interactions with the econometric model.
- [32] **Figure 6** is a block diagram showing the factors that are used by the user interface module.

DETAILED DESCRIPTION OF THE INVENTION

- [33] Referring to **Figure 1**, an overview of the process of the present invention is shown. The mortgage broker or lending institution first obtains a loan application from a borrower **10**. That information is electronically transmitted to the present invention, which parses the information **12** of the loan application into various categories that are relevant to the scoring of the potential loan. The loan application contents are parsed based upon the information needs of a sophisticated, mathematical model resident in the present invention. A prepayment score is then derived **14** for the particular consumer as a function of the particular loan type being requested, and in further view of the interest rate environment in which the loan is being processed (i.e. rising or falling interest rates). As previously noted this score is an indication of the prepayment propensity of a particular consumer. The prepayment score is then returned to the lender **16**. Thereafter the lender can create a customized loan product that rewards favorable prepayment behavior of the

consumer 18.

[34] Referring to **Figure 2**, an overview of the system of the present invention is shown. A loan originator **20** receives the application from a potential consumer. That application is then input to the loan originator's data delivery channels **22**. Such data delivery channels **22** are (without limitation) e-mail, fax, Internet, and generally other electronic means. Other loan originators **34** also send their respective consumer applications over their own data delivery channels **36**.

[35] The present invention anticipates delivery of loan applications **24** over the Internet **28** or other digital electronic means such as wireless communications methods as well. Electronic loan applications **40** enter the system of the present invention through a communication server **42**. The loan information concerning a given consumer is then submitted to an application parser **52**. Application parser **52** divides the information into loan information **58** and applicant information **56**. Loan information **58** is information that relates to the amount, the term, down payment, loan type, and other information important and relating to the amount of money to be loaned. Applicant information **56** is information such as name, address, Social Security number, and other demographic information concerning the applicant.

[36] Loan information **56** is fed into a prepayment model library database **66**. The prepayment model library database **66** comprises information concerning prepayment historical data **62**. The results are fed into model training server **64** which processes prepayment historical data **62** of both an individual and demographic groups which in turn provides updates to the model library database **66**.

Once loan information 58 is processed by the prepayment model library database 66 an analytical prepayment model 60, which is based upon the loan information 58 is provided to the prepayment calculation server 46. Prepayment calculation server 46 receives additional information from econometric model 48 which establishes the relationship among the wide variety of variables. Econometric model 48 generates interest rate, mortgage rate and other economic parameters that, arrayed in time series, comprise scenarios utilized by the prepayment calculations server. These scenarios are generated from the Low Discrepancy Sequence (LDS) logic, rather than using random number generation. The LDS logic affords significantly higher model accuracy with the same number of scenarios.

[37] Once a prepayment score 44 is derived by prepayment calculation server 46, prepayment score 44 is sent to the communication server 42 and is transmitted over the Internet (or other electronic channels) 28 through the data delivery channels 22 or 36 back to loan originators 20 or 34 who can then either approve, disapprove, or create customized loan product for the consumer.

[38] Prepayment score 38 is calculated based upon the following model. The specific prepayment analysis of the present invention is conceptually shown below.

[39] The following variables:

[40] $A = (a_1, a_2, \dots, a_n)$

[41] $L = (l_1, l_2, \dots, l_m)$

[42] are vectors of the applicant's data and loan parameters.

[43] $E_s(t) = (e_{1s}(t), e_{2s}(t), \dots, e_{ks}(t)); \quad s = 1, \dots, S$

[44] denotes a set of Low Discrepancy Sequence (LDS)-based scenarios of the econometric parameters, which have been generated by the RTH Linked Index Econometric Model. Thus the model is a set of stochastic differential equations that describe the dynamics and interaction of major macroeconomic indicators, each relevant to the prepayment propensity calculation.

[45] Analytical Prepayment Model \mathfrak{R} , which varies with the types of loan applied for, is trained to calculate prepayment value p_s in a given scenario based on the applicant's data (A), loan parameters (L), and econometric parameters (E):

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

[46] Total prepayment, accumulated by the time T in scenario s , can be calculated as:

$$P_s(T) = \prod_i p_s(t_i)$$

[47] Then, total prepayment at time T is given by:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

[48] Finally, the prepayment score is:

$$Score = \sum_T TP(T)$$

[49] The analytical model that produces the prepayment score may be further informed

by additional external behavioral or econometric factors, based on subsequent research, as well as the aforementioned behavioral scoring of mortgage broker behavior.

[50] The present invention may also be represented in an alternative embodiment in the form of the credit engineering workstation (CEW). This CEW (more fully described below) comprises a user interface which allows a loan originator to conduct all of the prepayment calculations, model analysis, and pricing of the present invention using the prepayment model first noted above.

[51] The CEW operates in either a Unix or Windows NT environment using Oracle, SQL server, Sybase, DB2, or Informix database support. The CEW also uses CORBA or, structured object models together with a JAVA/HTML browser based graphical user interface.

[52] The subroutines of the CEW all contribute to the end goal of determining the prepayment propensity of a consumer. For example, subroutines of the present invention deal supports the generation of various interest rate scenarios, and subsequent economic scenarios model fitting processes that fit the modeled interest rates scenarios to historical and current interest rate yield curve performance as well as to other macro economic indicators.

[53] Part of the system includes rewards pricing logic to efficiently measure and price the impact of rewards on consumer prepayment behavior. For example it would be most beneficial to a lender to reward the consumer for not prepaying the lender's loan. Such a reward could be assessed in terms of its impact on the consumer

prepayment behavior. The system therefore permits the end-user to design pro forma rewards structures and to test their impact on prospective consumer prepayment behavior.

[54] Various user definable screens also establish default spreads, prepayment spreads, broker commission schedules, and other financial factors that influence the pricing of the product to be offered to the consumer. Various other economic scenarios are collected via the user interface and combined with various probabilities and default data as well as other lender defined criteria result in rationally priced end-user mortgage contracts.

[55] Referring to **Figure 3**, further information concerning the CEW of the present invention shown. The system comprises user interface module **70** which is the basic graphical user interface and other software that allows an originator to provide information concerning a consumer who wishes to borrow money from lender. The user interface module allows the collection of loan attributes **76**, applicant attributes **74**, and reward program attributes **72**. In addition user interface module **70** collects or calculates spreads, broker commissions and other costs associated with the loan **78**. Loan attributes **76** and other loan related costs are fed into pricing engine **84** which, with other information, assists in creating an appropriate loan price **86**.

[56] Loan attributes **76**, applicant attributes **74**, and reward program attributes **72** all which have an impact on the value of the loan are fed into prepayment calculation server **80**. Prepayment calculation server **80** receives input from the various prepayment model parameters and creates prepayment score **82**.

[57] Referring to **Figure 4**, a block diagram showing the interactions which are necessary to create a prepayment model are shown. Consumer information **96** which consists of applicant attributes **74** and loan attributes **76** are fed into a prepayment model fitting **92** module. Prepayment model fitting **92** establishes various prepayment model parameters **94** based upon prepayment historical data **90**. Once the appropriate prepayment model is created by prepayment model fitting **92**, a model is returned to the prepayment calculation server for the calculation of the prepayment score of the particular consumer given the type of loan to consumer is requesting. The prepayment calculation server also benefits from input from an econometric model scenario generator.

[58] Referring to **Figure 5**, the interactions for the econometric model are shown. Econometric model scenario generator **106** receives input from econometric model fitting module **104** and LDS scenarios **108**. Econometric model fitting module **104** receives information from econometric historical data **100** and current market environment **102** which comprises, without limitation, information concerning rising or falling interest rates and trends. The information from econometric historical data **100** concerns the demographic group to which the consumer belongs and other econometric information such as age, income, credit rating, occupation and other factors. The information from current market environment **102** concerns the direction and velocity of changes to interest rates. Econometric model scenario generator **106** processes the information and produces various scenarios based on the information.

[59] Referring again to **Figure 3**, prepayment calculation server **80** creates prepayment score **44** for the particular consumer in question. Prepayment score **44** is based upon

the established prepayment model and the generated econometric model.

Prepayment score **44** is transmitted to the pricing engine **82** to establish the pricing of the loan product to be offered to the consumer in question.

[60] Referring to **Figure 6**, additional parameters which the user interface module uses to create the various scenarios are shown. Additional aspects of the present invention provide for creation of new products. Strategy optimizer **122** is based upon acceptance of offered products by consumers and input from and relating to other products are on the market. Strategy optimizer **122** generates marketing plans based upon individual lenders' portfolios. Such a market plan could assist the lender in offering new products to the marketplace that are more profitable for the lender. The system includes targeting optimizer **124** which provides a way to offer loan products to those consumers having the most favorable prepayment characteristics, i.e., a low propensity to prepay loans made. The system also comprises loyalty optimizer **126** which models and defines offers and other inducements to consumers to reward financially advantageous consumer behavior. Channel optimizer **128** is part of the present invention. Channel optimizer **128** analyzes the channels of delivery of financial product offerings to evaluate and determine the channel that is the most efficient way to deliver various financial products. The system also comprises database optimizer **130** which receives and organizes information in the various databases to constantly build and refined prepayment historical data **90** and econometric historical data **100**.

[61] The target platform on which the system of the present invention will run is either an Intel Pentium processor based system with typically 32 megabytes of RAM, hard

disk storage and retrieval, and communications capability using the TCP/IP protocol. Alternatively the system will also run under the UNIX operating system on a Sun Solaris platform. In both cases displays for users are anticipated as is the ability to output hard copy reports. In typical operation, a plurality of users, remote from the system site will access the system via private networks or over the Internet to send the information necessary for the present invention to make the desired calculations leading to the prepayment score. This score is then sent back to the requesting user at the remote terminal.

[62] Although described herein with respect to a mortgage loan or loan, the present invention is applicable to numerous financial instruments that have a value that depends on the particular consumer's actions over time. The value of typical debt instruments, such as, but not limited to, mortgages, second mortgages, home equity loans, car loans, school loans, term loans, leases, credit card accounts, and credit card balance transfers, depend on a continued stream of cash and are therefore affected significantly by prepayment.

[63] The value of other instruments that depend on the cash stream over time, such as open-end car leases and whole-life insurance policies, can also depend on the consumer's actions, and therefore, for purposes of this invention can be considered as a form of debt instrument. In the car lease scenario, predicting the probability of a consumer electing to purchase or return the car before the end of the lease (prepay) is important in determining the value of the lease. Even a consumer's predisposition to keeping (purchasing at residual value price, a type of prepayment) or returning the car at the end of the lease can be used to modify the lease terms to the leasing entity's

advantage.

[64] Likewise, the likelihood of a consumer to cash out the surrender value of a whole-life insurance policy (another form of prepayment, albeit in the opposite direction, that ends the stream of cash) can significantly affect the ultimate value of the policy to the insurer.

[65] Known database and computer-based data mining techniques can be used for analyzing: the value of financial instruments (and portfolios in which they are packaged) based on the prepayment score associated with each of them; the risk associated with portfolios containing the financial instruments; and the pricing for servicing those portfolios. Additionally, instruments can be packaged together into portfolios based, at least in part, on the prepayment scores of the applicants.

[66] A system and method for prepayment score generation has been described. Those skilled in the art will appreciate that other variations of the present invention are possible without departing from the scope of the invention as described.

WHAT IS CLAIMED IS:

[c1] A system for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:

at least one debt instrument origination computer terminal for accepting and transmitting a debt instrument application of an individual applicant;

a computer network connected to the at least one debt instrument origination computer terminal for receiving the transmitted debt instrument application of the individual applicant;

a communication server connected to the computer network for receiving the transmitted debt instrument application of the individual applicant;

an application parser connected to the communications server for receiving the transmitted debt instrument application of the individual applicant from the communications server and parsing the information into debt instrument information and applicant information;

a prepayment model library database comprising debt instrument prepayment models connected to the application parser for receiving the debt instrument information and fitting the debt instrument information into the debt instrument prepayment models and for transmitting debt instrument prepayment models that match the debt instrument information; and

a prepayment calculation server comprising a prepayment score generation model connected to the prepayment model library database for receiving the debt instrument

prepayment models and calculating a prepayment score for the debt instrument application of the individual applicant based upon the debt instrument prepayment model and the prepayment score generation model, the prepayment calculation server being further adapted to transmit the prepayment score to at least one debt instrument origination computer terminal via the communications server and the computer network;

where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment; and

wherein the at least one debt instrument origination computer terminal is adapted to use the prepayment score to adjust terms of the debt instrument of the individual applicant.

[c2] The system for determining a prepayment score of claim [c1], where the prepayment model library database further comprises:

a model training server for creating the debt instrument prepayment models for the prepayment model library database; and

prepayment historical data storage means connected to the model training server, the prepayment historical data further comprises prepayment statistics regarding debt instruments of various types.

[c3] The system for determining a prepayment score of claim [c1], where the prepayment calculation server further comprises an econometric model that

generates Low Discrepancy Sequence (LDS)-based scenarios of econometric parameters for input to the prepayment calculation server.

- [c4] The system for determining a prepayment score of claim [c1], further comprising means adapted to calculate a total prepayment at time T from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

- [c5] The system for determining a prepayment score of claim [c4], further comprising means adapted to calculate the total prepayment, accumulated by time, in scenario s from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

- [c6] The system for determining a prepayment score of claim [c5], further comprising means adapted to calculate the prepayment value in a given scenario from the formula:

$$p_s(t) = \Re (A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \Re is an analytical prepayment model.

[c7] The system for determining a prepayment score of claim [c1], where the applicant is either an individual consumer or an individual household.

[c8] The system for determining a prepayment score of claim [c1], further comprising computer-based means for using data associated with the prepayment score of the applicant and terms of the debt instrument to determine a calculation selected from the group consisting of: a value of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c9] A method for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:

collecting debt instrument and applicant information at a debt instrument originator;

transmitting the debt instrument and applicant information over a network;

receiving the debt instrument and applicant information at a service bureau;

the service bureau calculating a prepayment score the individual applicant, where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment;

the service bureau returning the prepayment score over the network to the debt

instrument originator; and

the debt instrument originator using the prepayment score to customize a debt instrument product for the individual applicant.

[c10] The method for determining a prepayment score of claim [c9], where calculating a prepayment score for the applicant comprises parsing the information into debt instrument information and applicant information.

[c11] The method for determining a prepayment score of claim [c10], further comprising providing the applicant information to a prepayment model library database and the debt instrument information to a prepayment calculation server.

[c12] The method for determining a prepayment score of claim [c11], further comprising the prepayment model library determining the prepayment model that best applies to the debt instrument information and providing that prepayment model to the prepayment calculation server.

[c13] The method for determining a prepayment score of claim [c12], further comprising the prepayment calculation server receiving a prepayment model and an econometric model, where the prepayment calculation server further calculates a prepayment score for the applicant.

[c14] The method for determining a prepayment score of claim [c13], where the total prepayment at time T is calculated from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

[c15] The method for determining a prepayment score of claim [c14], where the total prepayment, accumulated by time, in scenario s is calculated from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

[c16] The method for determining a prepayment score of claim [c15], where the prepayment value in a given scenario is calculated from the formula:

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \mathfrak{R} is an analytical prepayment model.

[c17] The method for determining a prepayment score of claim [c9], where the applicant is defined as an individual consumer or an individual household.

[c18] The method for determining a prepayment score of claim [c9], further comprising rating a broker based on prepayment scores of applicants that are clients of said broker.

[c19] The method for determining a prepayment score of claim [c9], further comprising using the prepayment score of the applicant and terms of the debt instrument to assist in determining a calculation selected from the group consisting of: a value

of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c20] The method for determining a prepayment score of claim [c9], further comprising packaging said debt instrument into a portfolio based, at least in part, on the prepayment score of the applicant.

Abstract of the Disclosure

A method and apparatus is disclosed for determining the prepayment propensity of individual borrowers. Early payment of debt instruments, such as loans and leases, can lead to losses being suffered by lenders. The present invention analyzes the demographics associated with a particular borrower to determine both the individual and group based prepayment propensity. The history of the borrower, the history of the borrower's demographic group, interest rate trends and other factors are then used to calculate a prepayment score that can be used by the lender to determine the propensity of a given borrower to prepay the instrument in question. The score of the individual borrower can be used to estimate the profitability of a debt instrument and allow the lender to make appropriate adjustments prior to issuing the instrument. The individual prepayment scores of a lender's or broker's clients can also be used to rate the lender or broker.

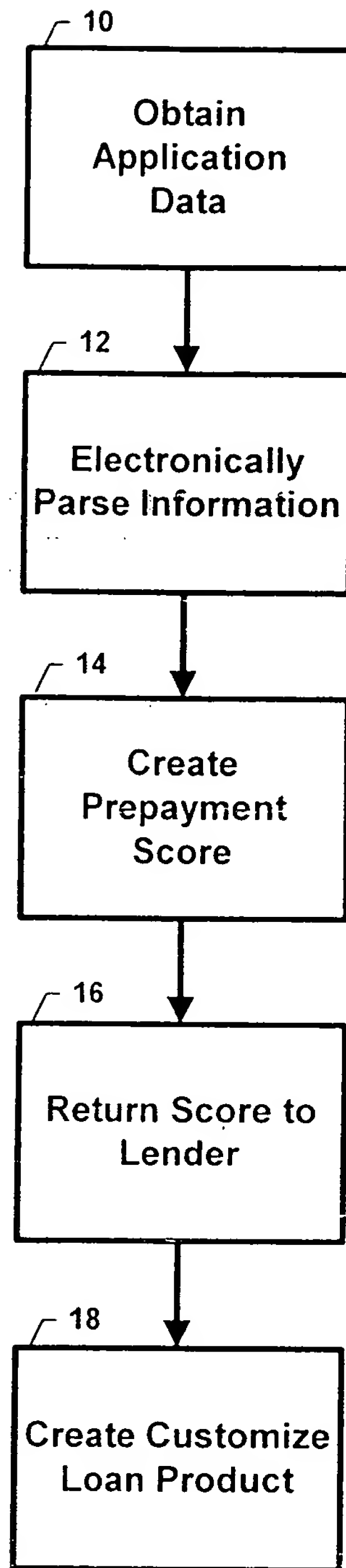


FIGURE 1

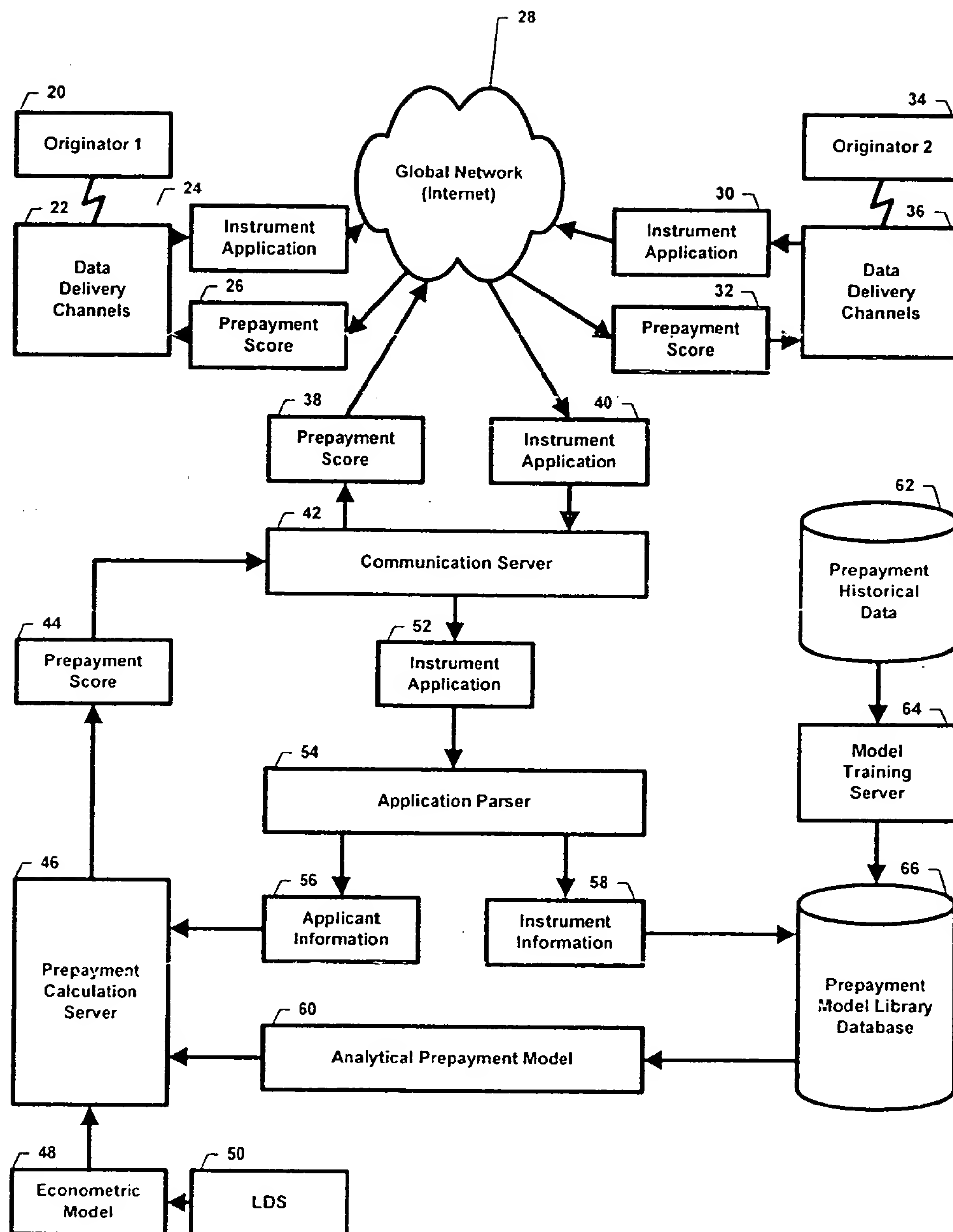


FIGURE 2

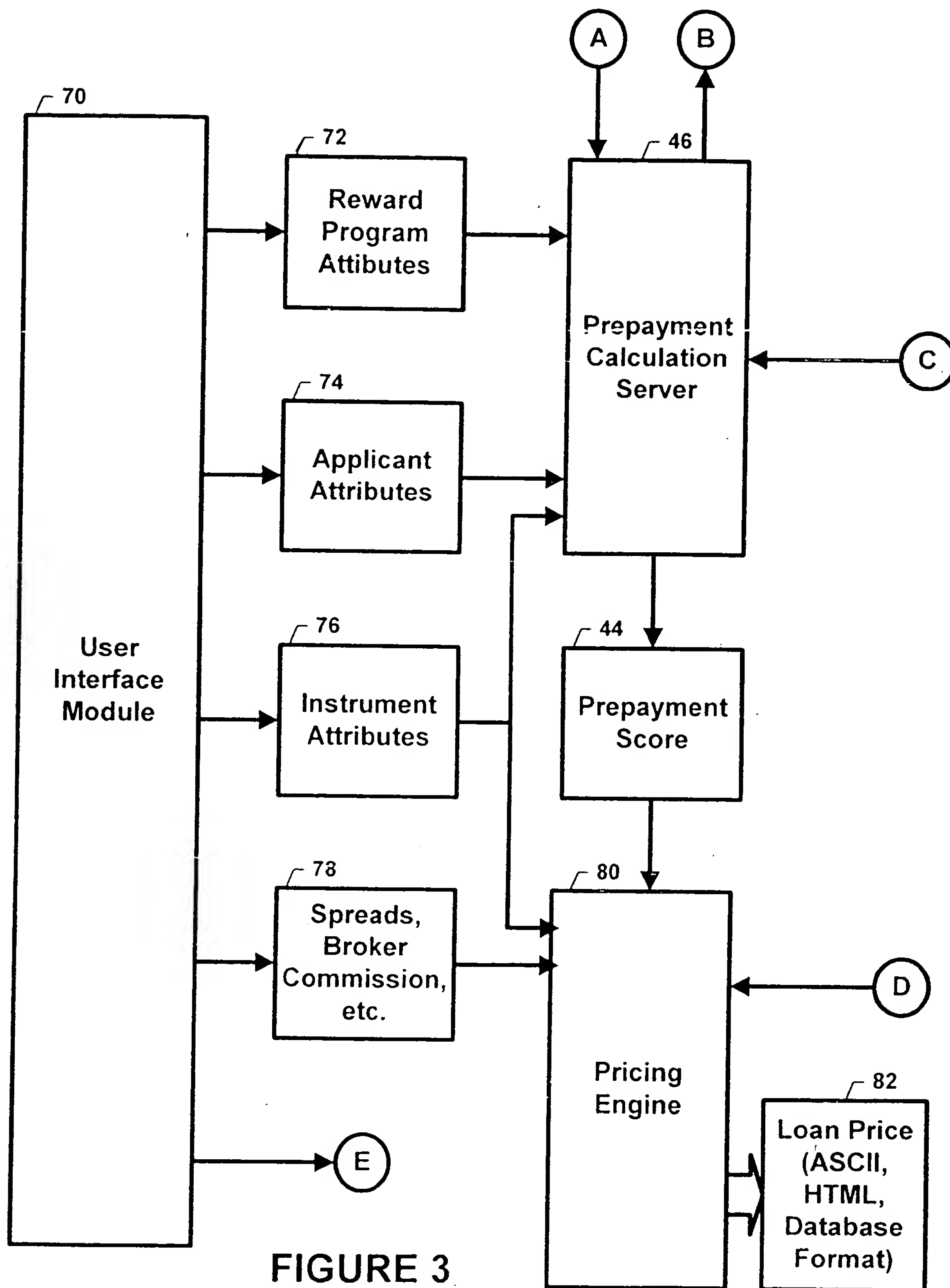


FIGURE 3

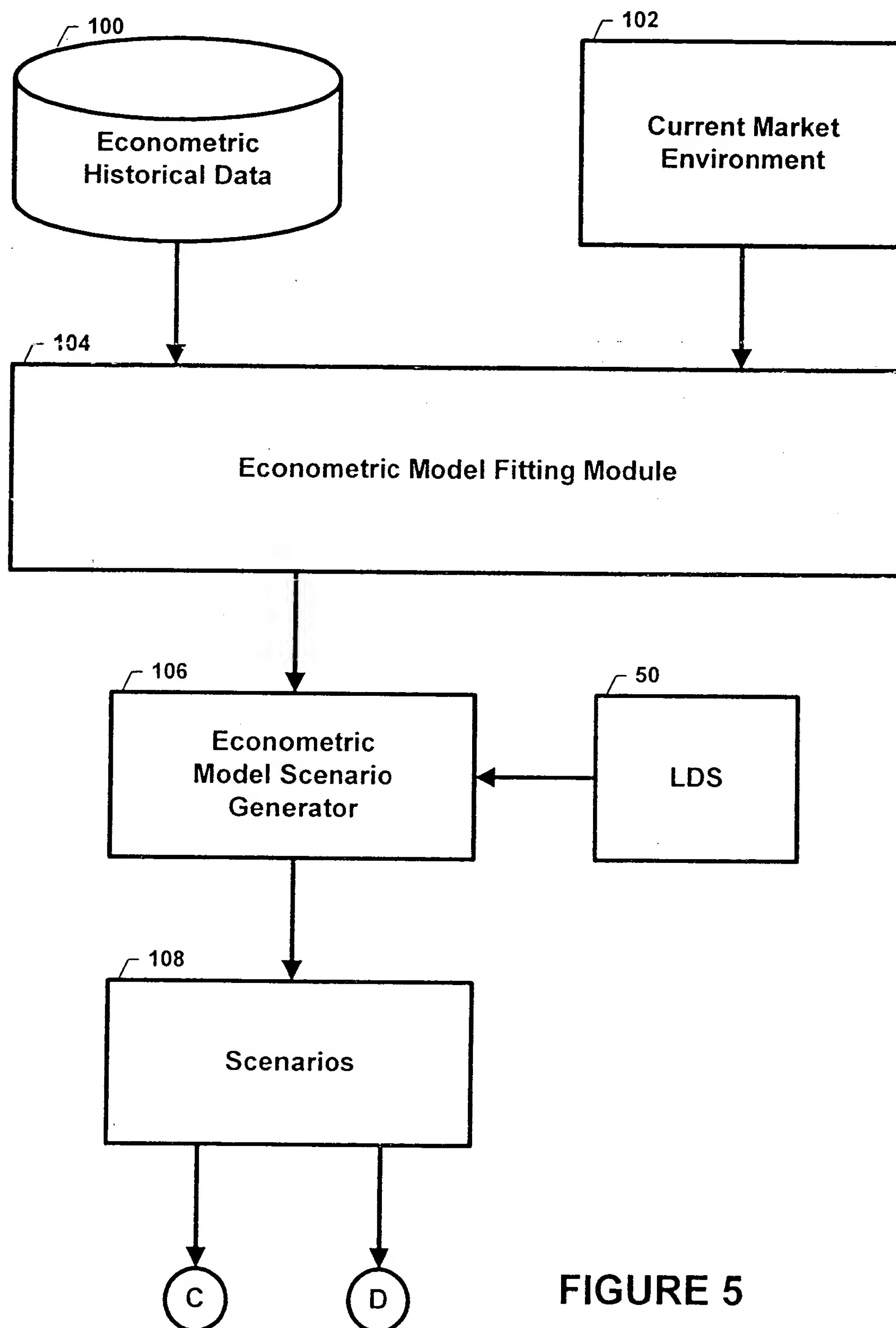


FIGURE 5

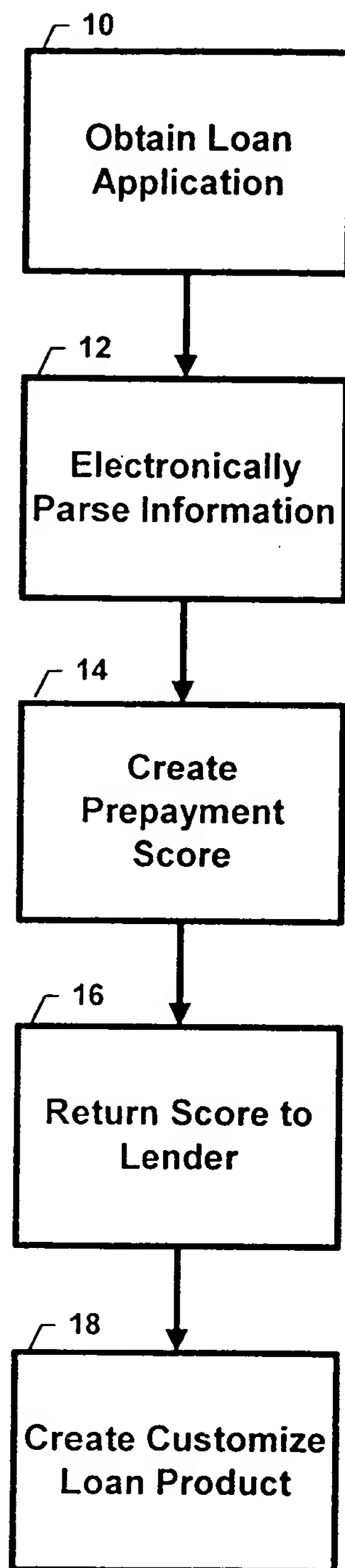


FIGURE 1

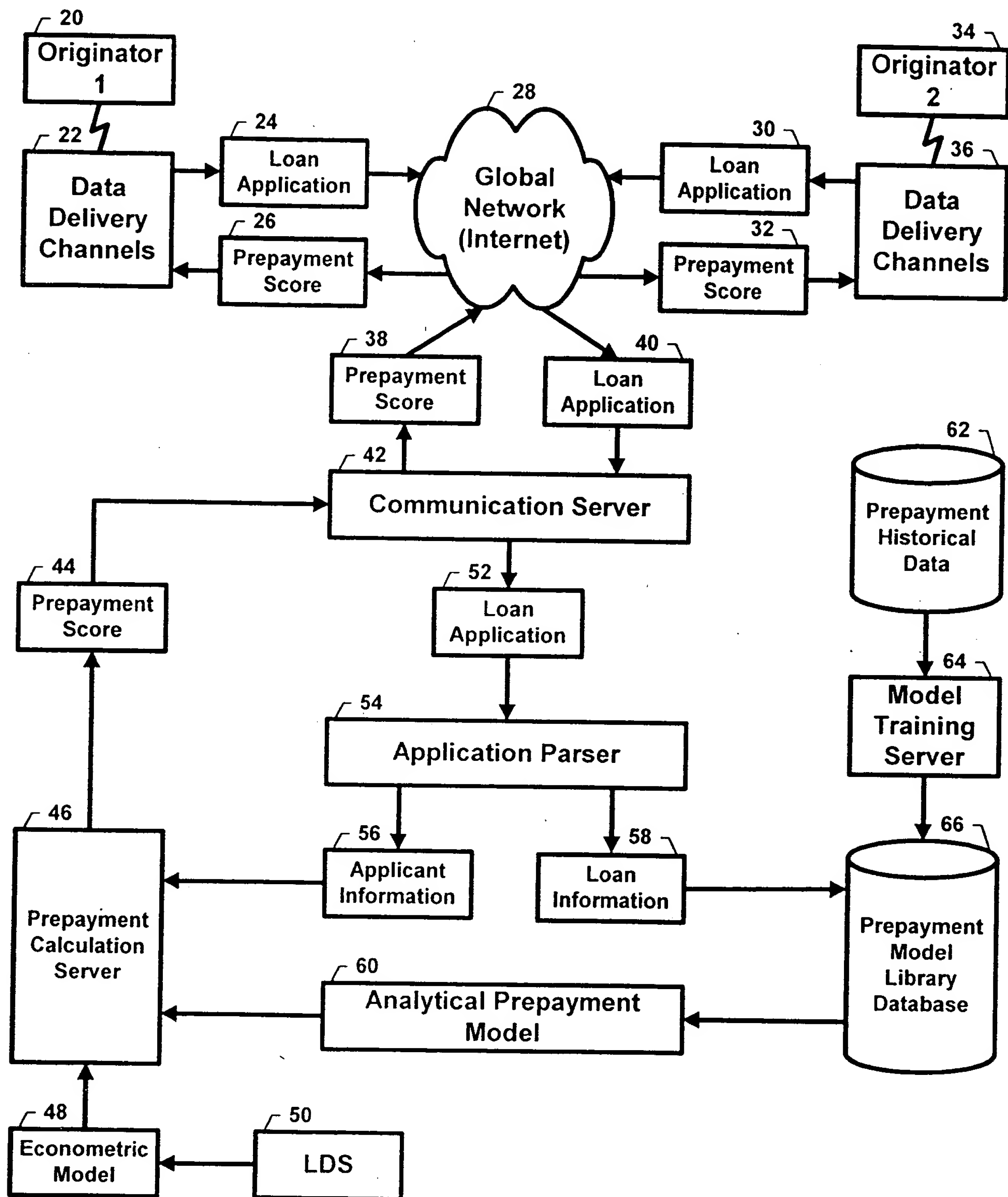


FIGURE 2

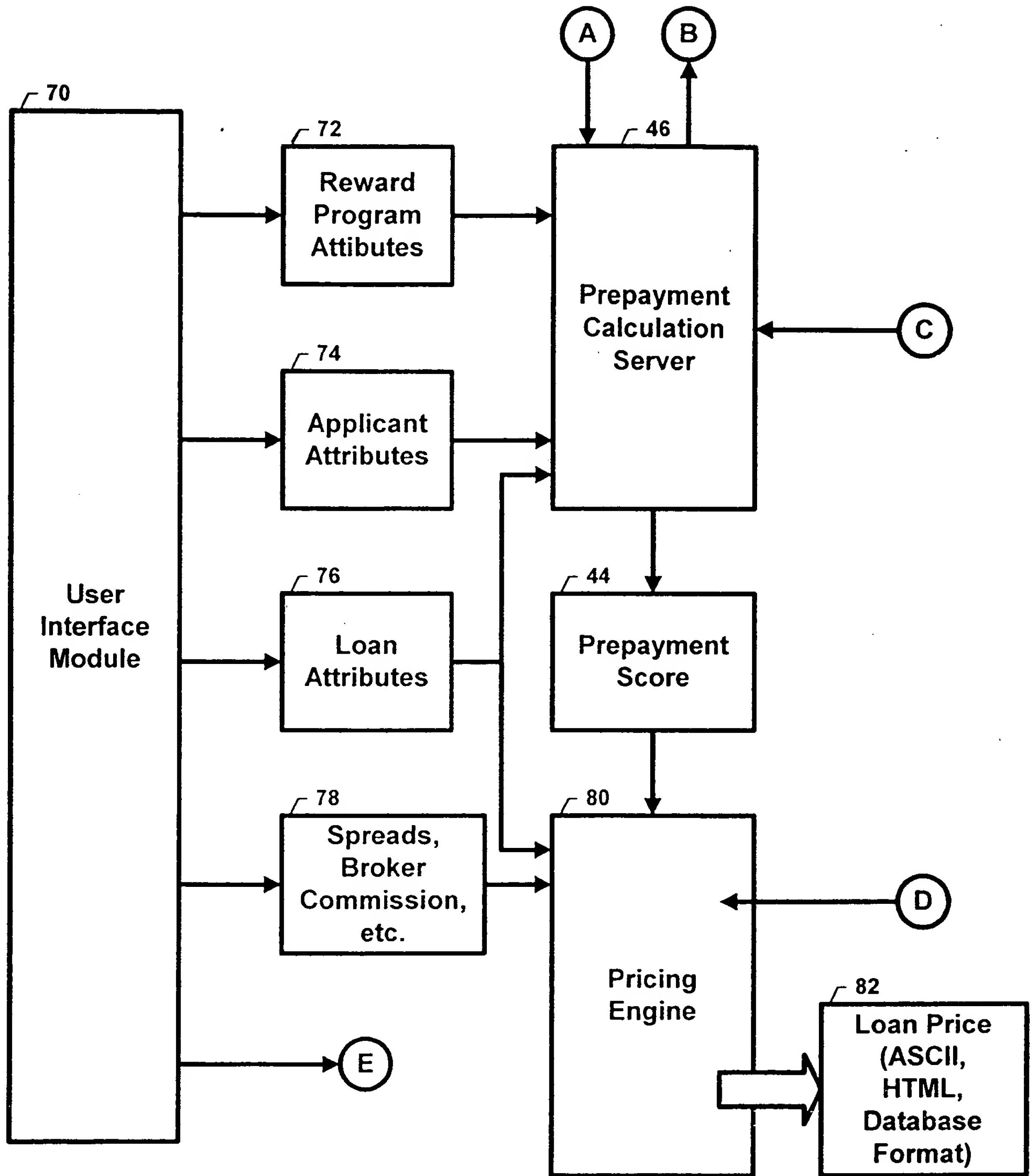


FIGURE 3

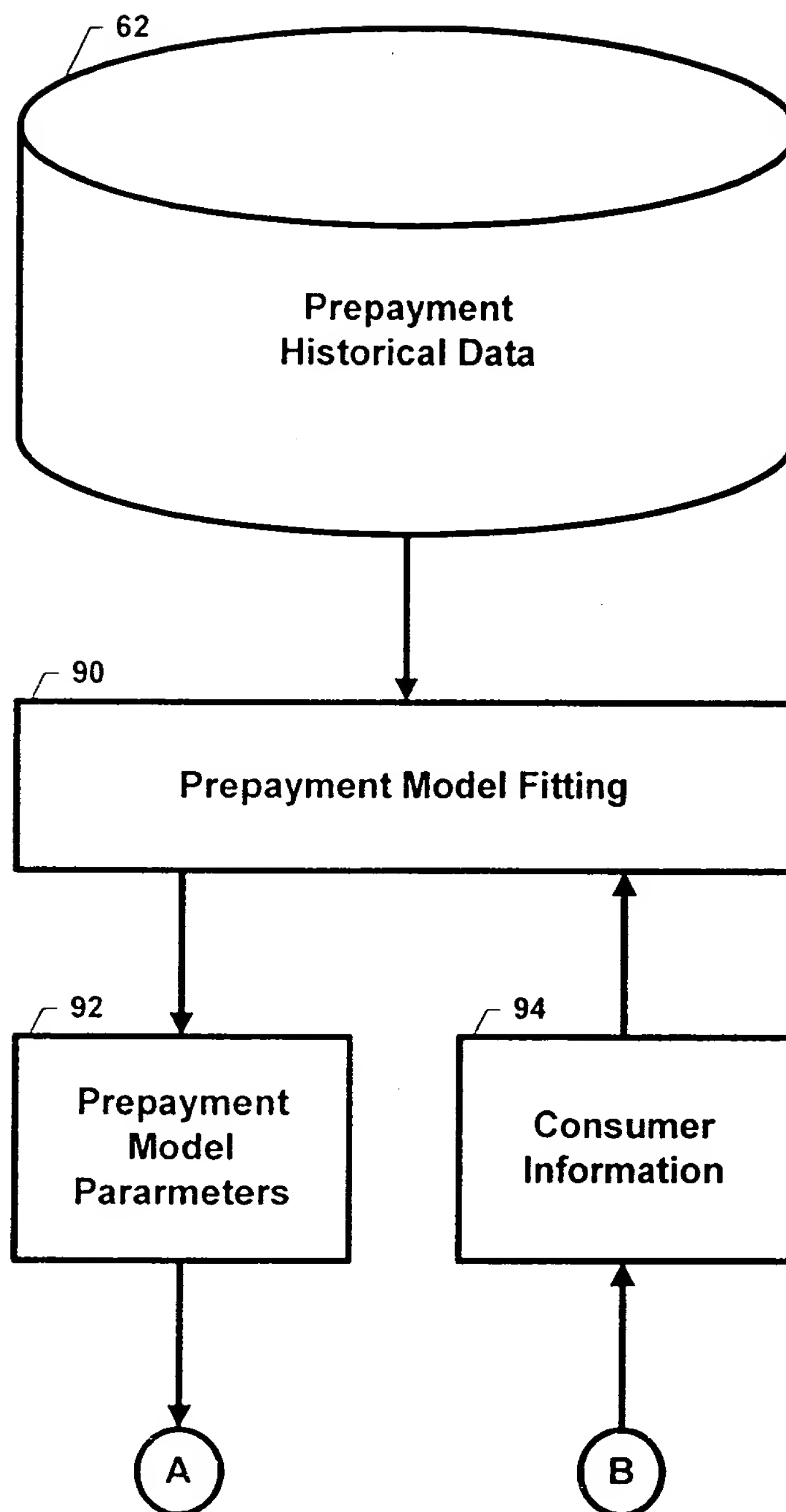


FIGURE 4

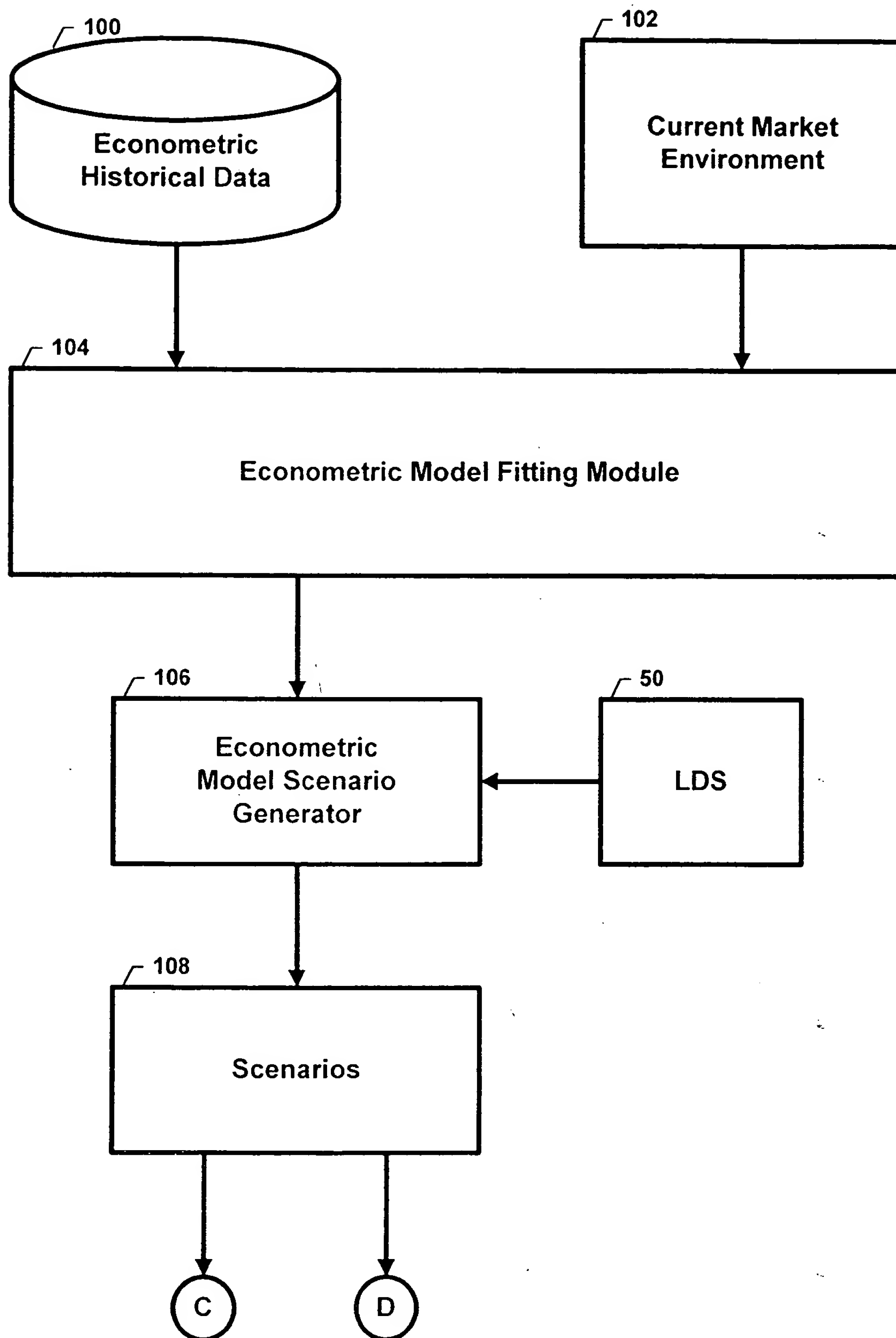


FIGURE 5

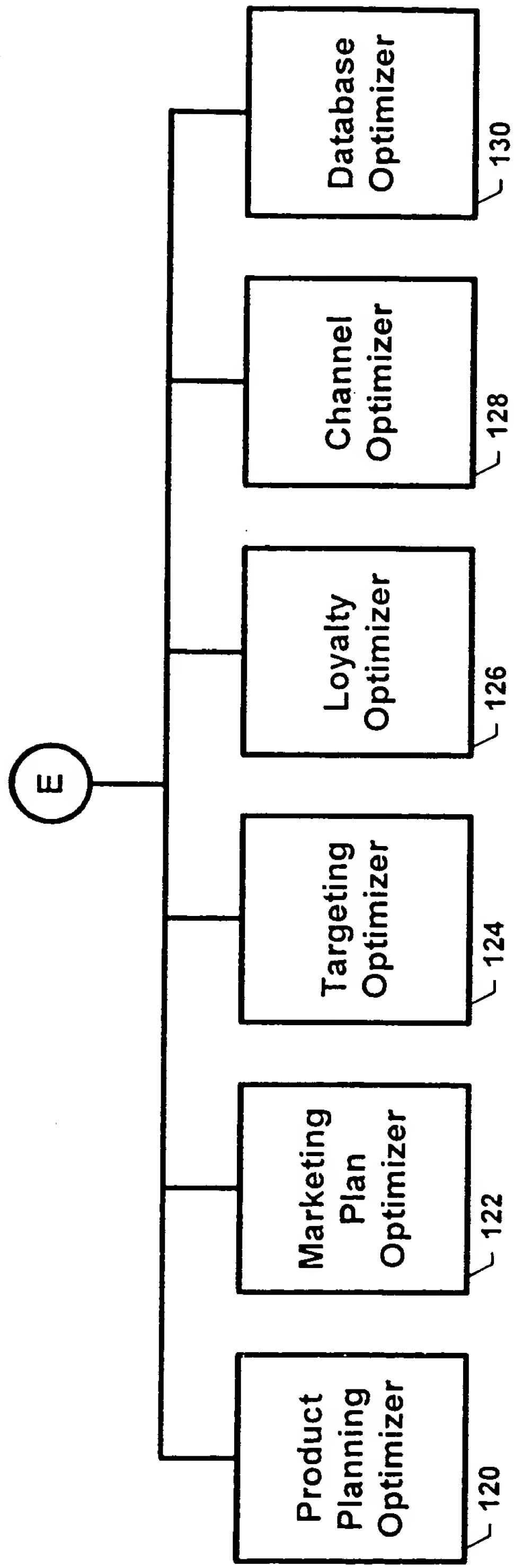


FIGURE 6

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Yuri Galperin, et al.
Appl. No. : 09/942,983
PCT Filing Date : August 30, 2001
For : METHOD AND APPARATUS
FOR DETERMINING A
PREPAYMENT SCORE FOR AN
INDIVIDUAL APPLICANT
Examiner : Siegfried E. Chencinski
Group Art Unit : 3692

STATEMENT OF CHARLES L. JONES III UNDER 37 C.F.R. § 1.48(a)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Charles L. Jones III, do declare as follows:

1. I am a citizen of the United States and reside at _____.
2. The above-referenced patent application was filed on August 30, 2001 listing Yuri Galperin, Vladimir Fishman and William A. Eginton as the joint inventors.
3. I believe that I, Charles L. Jones III, should also be named as an inventor in the above-referenced application.
4. The inventorship error occurred without deceptive intent on my part.

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or document, or any registration resulting therefrom.

Dated: _____

Charles L. Jones III

ASSIGNMENT

WHEREAS, I, Charles L. Jones III, residing at _____, am a joint inventor, along with Yuri Galperin, Vladimir Fishman, and William A. Eginton, of certain new and useful improvements in a METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT for which we have filed an application for Letters Patent in the United States, Application No. 09/942,983 Filed on August 30, 2001;

AND WHEREAS, MarketSwitch Corporation (hereinafter "ASSIGNEE"), a Delaware corporation, with its principal place of business at 2350 Corporate Park Drive, Suite 400, Herndon, VA 20171, desires to acquire the entire right, title, and interest in and to said improvements and said Application:

NOW, THEREFORE, in consideration of the sum of One Dollar (\$1.00) to me in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, I, said inventor, do hereby acknowledge that I have sold, assigned, transferred and set over, and by these presents do hereby sell, assign, transfer and set over, unto said ASSIGNEE, its successors, legal representatives and assigns, the entire right, title, and interest throughout the world in, to and under said improvements, and said application including all provisional applications relating thereto (including but not limited to U.S. Provisional Application No(s). 60/228,954, filed August 31, 2000 (respectively if plural applications)), and all divisions, renewals and continuations thereof, and all Letters Patent of the United States which may be granted thereon and all reissues and extensions thereof, and all rights of priority under International Conventions and applications for Letters Patent which may hereafter be filed for said improvements in any country or countries foreign to the United States, and all Letters Patent which may be granted for said improvements in any country or countries foreign to the United States and all extensions, renewals and reissues thereof; and I hereby authorize and request the Commissioner of Patents of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents on applications as aforesaid, to issue all Letters Patent for said improvements to said ASSIGNEE, its successors, legal representatives and assigns, in accordance with the terms of this instrument.

AND I DO HEREBY sell, assign, transfer, and convey to ASSIGNEE, its successors, legal representatives, and assigns all claims for damages and all remedies arising out of any violation of the rights assigned hereby that may have accrued prior to the date of assignment to ASSIGNEE, or may accrue hereafter, including, but not limited to, the right to sue for, collect, and retain damages for past infringements of said Letters Patent before or after issuance.

AND I HEREBY covenant and agree that I will communicate to said ASSIGNEE, its successors, legal representatives and assigns, any facts known to us respecting said improvements, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuing and reissue applications, make all rightful oaths and generally do everything possible to aid said ASSIGNEE, its successors, legal representatives and assigns, to obtain and enforce proper patent protection for said improvements in all countries.

Application No.: 09/942,983
Filing Date: August 30, 2001

Client Code: EXP.046A
Page 2

IN TESTIMONY WHEREOF, I hereunto set my hand and seal this ____ day of _____, 20__.

Charles L. Jones III

STATE OF }
 } ss.
COUNTY OF }

On _____, before me, _____, notary public, personally appeared **Charles L. Jones III** personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged to me that he executed the same in his authorized capacity(ies), and that by his signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

[SEAL]

Notary Signature

4094063:kc
080207

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Second inventor: **Vladimir Fishman**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Third inventor: **William A. Eginton**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Fourth inventor: **Charles L. Jones III**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: _____

Mailing Address: same as above

Send Correspondence To:
KNOBBE, MARTENS, OLSON & BEAR, LLP
Customer No. 20,995

4093879.kc
080207

First-Class Mail
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UNITED STATES POSTAL SERVICE

• Sender: Please print your name, address, and ZIP+4 in this box.

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IRVINE, CA 92614
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IRVINE, CA 92614

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JAN 23 2008

#960-8X3

TMC

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3. Also complete item 4 if Restricted Delivery is desired.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Charles Jones
4570 Old Post Rd
Charlestown, RI
02813-2560

2. Article Number

(Transfer from service label)

7006 0100 0004 5806 4533

PS Form 3811, February 2004

7006 0100 0004 5806 4533

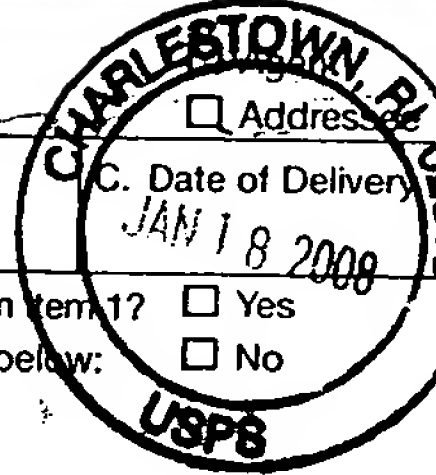
PSN 72595-02-M-1540

COMPLETE THIS SECTION ON DELIVERY**A. Signature**

X *[Signature]*

B. Received by (Printed Name)☐ Addressed to**C. Date of Delivery**

JAN 18 2008

D. Is delivery address different from item 1? ☐ YesIf YES, enter delivery address below: ☐ No**3. Service Type**

- ☒ Certified Mail ☐ Express Mail
☐ Registered ☐ Return Receipt for Merchandise
☐ Insured Mail ☐ C.O.D.

4. Restricted Delivery? (Extra Fee)☐ Yes**U.S. Postal Service™
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PS Form 3800, June 2002

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7006 0100 0004 5806 4533

March 3, 2008

VIA CERTIFIED MAIL
No. 7006 0100 0004 5806 4427

Charles L. Jones III
4570 Old Post Road
Charlestown, RI 02813-2560

Re: Patent Application for Prepayment Score
Application No. 09/942983
Our Reference: EXP.046A

Dear Mr. Jones:

As you know, a patent application for your invention entitled METHOD AND APPARATUS FOR DETERMINING LOAN PREPAYMENT SCORE was filed on May 15, 1998 and assigned Application No. 09/078,867, which is now issued Patent No. 6,185,543. You, Yuri Galperin, Vladimir Fishman and William A. Eginton were listed as inventors on this application. A later related application was filed on August 30, 2001 and assigned Serial No. 09/942,983, but did not include you as an inventor. It is our understanding that you were erroneously left off this application through no deceptive intent on your part.

Therefore, we are filing a Petition with the U.S. Patent Office to correct inventorship on the related application. In order to correct inventorship we need you to sign a declaration acknowledging that you and the other three inventors are the inventors of this application. In addition, you need to sign a Statement indicating that you were erroneously left off this application through no deceptive intent on your part ("Statement").

I have enclosed a copy of the application as filed (including the specification, drawings and claims), the Statement and an Assignment of the invention to Marketswitch. Please review the application to confirm that you should be added as an inventor.

I have previously sent you other copies of the same documents that I have enclosed in this letter, but I have not received a response. Please respond to this letter as soon as possible so that we can promptly correct inventorship in the application.

Charles L. Jones III

March 3, 2008

Page -2-

After your review, please sign and promptly return to me the Declaration, the Statement, and the Assignment in the pre-addressed envelope.

If you have any questions or if you would like to discuss this matter, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Ted M. Cannon", with a long horizontal flourish extending to the right.

Ted M. Cannon

Enclosures

4961618

SPECIFICATION

TITLE: METHOD AND APPARATUS FOR DETERMINING A
PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT

RELATED APPLICATIONS

- [01] This application claims the benefit of Provisional Application Serial No. 60/228,954, filed August 31, 2000, which is incorporated herein in its entirety.

FIELD OF THE INVENTION

- [02] This invention relates generally to receiving applications for and processing of lending transactions. More specifically this invention provides a method and apparatus to assess the prepayment propensity of a borrower in the form of a prepayment "score" to enable assessment of (i) the value of mortgages, second mortgages, home equity loans or other debt instruments for investors, (ii) the value of credit card accounts and balance transfers, (iii) the value of term loans and leases, (iv) the behavior of brokers with respect to churning, (v) the valuation of existing portfolios, (vi) the risk management of institutions that hold debt instruments, and (vii) the pricing of mortgage portfolio servicing contracts.

BACKGROUND OF THE INVENTION

- [03] By way of an introductory example, consider the most common of debt instruments, the consumer mortgage. The value of a mortgage depends, in large part, on the duration of the mortgage. At the inception of the mortgage there are broker

fees and various other settlement costs that are charged to the lender. When a mortgage extends for the term of many years, there is an opportunity for the lender to recoup costs of putting a mortgage in place for a given consumer and to make profit on that mortgage. This is particularly important for all business organizations that lend money, but it is particularly important for those mortgage financing organizations which have stockholders and other investors.

[04] When a mortgage loan is paid off early due to refinancing, depending upon how early in the term, the mortgage loan is paid off, there is the possibility that the lending institution can actually take a loss on the particular mortgage. The rate of prepayment depends on a number of objective factors. For example, during times of decreasing mortgage rates, on average, more consumers refinance their home loans than would otherwise occur, in order to obtain a lower monthly payment. However, for a given macroeconomic environment and other measurable, objective factors, each consumer evidences an individual propensity to prepay a loan. This prepayment propensity reflects the consumer's demographic and other objective attributes. A system that can assess such individual prepayment behavior by a consumer in advance of the loan will lead to more profitable loans being made, and hence the enhanced availability of funds for loans to more consumer-borrowers. The present invention therefore may be applied, without limitation, to a) the pricing of mortgages and other debt instruments, b) the valuation of existing portfolios of debt instruments, and c) the risk management of institutions that hold debt instruments.

[05] Additionally, the present invention is not limited to the type of debt instrument or lending transaction to which the prepayment score is useful. The invention includes,

but is not limited to, mortgages (consumer and commercial), second mortgages, refinanced mortgages, consumer loans, commercial loans, asset-backed loans, consumer leases, commercial leases, credit card accounts, credit card balance transfers, debt consolidation loans (term notes, etc.), mortgage-backed securities (i.e., mortgage pass through, CMO's, mortgage-backed bonds, principal-only, interest-only, etc.), and any servicing contract for these lending transactions that performs financially based on the quality (i.e., duration) of the cash flow.

[06] A further element of the present invention is the monitoring and scoring of brokers for these lending transactions. Mortgage brokers deal with both consumer-borrowers and lenders-clients. In order to generate brokerage fees, it is possible for a broker to encourage its consumer-borrowers to refinance their mortgages frequently and prematurely. When this occurs, the mortgage broker generates a fee for the broker, however, early prepayment of the prior mortgage instrument can result in a loss for the lender. Thus the present invention also has the capability to score mortgage broker prepayment behavior.

[07] The behavior of a broker is sometimes not all heinous. Sometimes a consumer, who is particularly attuned to the rise and fall of interest rates, will simply be the one who changes mortgage instruments more frequently than the average consumer. The broker who is scored based upon the prepayment behavior of the consumers that the broker brings to lenders, would like to know the pre-payment propensity for the given consumer. This would be useful so that the mortgage broker can optimize the broker's relationship with its lender-clients by only bringing consumer-borrowers who have a low prepayment propensity.

[08] Therefore, lenders and brokers badly need the ability to better measure prepayment behavior in advance of incurring marketing or underwriting charges; these expenses are too great to absorb blindly on behalf of consumers with poor prepayment propensities. Indeed, a beneficial use of the invention would be in managing the initial marketing effort itself. For example, only those customers who can be shown to score favorably for prepayment behavior might receive a solicitation for a mortgage product A. Consumers who are revealed to represent a substantial prepayment risk may be offered a more suitable mortgage product B, reflecting the increased risk. In this way, enhanced customers segmentation and product design initiatives converge to benefit consumers and their sources of debt financing, to the benefit of each.

[09] To understand the potential impact of national prepayment scoring standard, as manifested in the present invention, one need look no farther than the existing default risk scoring standard, owned and distributed by Fair, Isaac and Company, Inc. (Fair Isaac) for over 30 years. By establishing a standard methodology for scoring borrower default risk, and broadly disseminating it, Fair Isaac dramatically enhanced mortgage lender insight into expected loan dynamics. In finance, enhanced insight is synonymous with enhanced information. Enhanced information implies reduced risk for the lender. Finally, reduced lender risk profiles produce lower costs of capital. In other words, because Fair Isaac standardized successfully a fungible measurement of default risk, more money is available for consumers to borrow, at better and cheaper interest rates. The market is more efficient than before and everyone benefits.

[10] To further qualifying the timeliness of the invention, please refer to exhibit 1, "Green Tree chief returns \$23 million..." The Wall Street Journal, March, 1998. This story highlights the industry wide uncertainty surrounding prepayment speeds in consumer debt portfolios. One industry leading company, Green Tree Financial, "has been hit hard the past year by escalating loan losses in the painful recognition that its accounting has been too aggressive. Also, an unexpected wave of loan prepayments hit the industry, as borrowers sought lower interest rates, indicating working-class consumers were not as unsophisticated as lenders had believed." Stated plainly, Green Tree overstated prior year earnings significantly, exercising its option under GAAP accounting to roll forward and capture in advance projected lending profits, even though those very profits were merely estimated based in part on arbitrary prepayment assumptions. In large measure because Green Tree badly miscalculated these prepayments speed assumptions, in 1997 the company was forced to charge off \$390 million of 1996 reported profit. In 1998 the company was sold off to Consec.

[11] Earlier disclosures in the area of prepayment scoring in a lending context are limited or nonexistent. United States Patent No. 5,696,907, entitled "System and Method for Performing Risk and Credit Analysis of Financial Service Applications," issued to Tom. The Tom patent discloses using a neural network to mimic a loan officer's underwriting decision making. The method of the Tom patent is based on a non-iterative regression process that produces an approval criterion that is useful in preparing new or modified underwriting guidelines to increase profitability and minimize losses for a future portfolio of loans. A prepayment observation is used in the neural net as a negative flag, but no prepayment scoring system is utilized in the

Tom patent.

- [12] In view of the prior art, there is a clear need for measuring and predicting a consumer's prepayment propensity, as well as a clear and strong need for a method and apparatus to produce such a measuring and predictive parameter.

BRIEF SUMMARY OF THE INVENTION

- [13] The system and method of the present invention generally works in the following manner: the service bureau or broker will electronically capture individual loan applications from consumers. Those loan applications will be sent to lenders for evaluation. The lender, using the present invention submits the loan application for review and analysis. The loan application will be reviewed by the present invention according to a sophisticated economic and customer behavior model, which will score the prepayment behavior of candidate borrowers. The score for these borrowers, which is an index of their prepayment propensity, will be electronically returned to the lender. The lender will in turn use the prepayment score and calibrate an appropriate mortgage price including the setting of interest rates, fees, broker commissions, and potentially consumer rewards. Using this consumer scoring technique, a lending institution can seek to contact or contract with those consumers who display a low propensity to prepay.

- [14] The advanced scoring of customer prepayment propensities materially improves the lender's to risk profile as regards new lending customers. This novel insight adds value to the marketing, underwriting, lending, administrative process for first and second mortgages, credit card balance transfers, and asset-backed term loans such as

automobile loans. By assisting lenders in their efforts to segment customers according to this crucial behavior metric, waste and excess costs are driven from the lending economy. More money is thus available, more cheaply, for more people.

[15] To the borrower, this system offers several advantages. First, more favorable loan terms can be made to those consumers who exhibit a beneficial borrowing behavior, i.e., borrowers who are not likely to prepay their loans but instead maintain their loans for a profitable duration. Further, dealing with a stable borrower market results in a more favorable financial environment on for all lenders thereby mitigating the risk of loss and, in the normal course of all efficient markets, passing that financial advantage onto borrowers generally.

[16] Once again, the irrefutable economic relationship between financial risk-taking and expected financial reward informs the environment addressed by the present invention. If lenders reduce their risks-and by extension their costs-through enhanced prepayment scoring, ultimate borrowing costs paid by consumers will decline.

[17] For the loan originator, the system offers several advantages. The loan originator can more efficiently price the particular loan. Further the loan originator can more efficiently select brokers and intermediaries who will select the best borrowers. Further, the system and method of the present invention will lead to more efficient direct and indirect marketing investments by identifying individual consumers and groups of consumers who exhibit the most beneficial borrowing behavior, i.e., a propensity not to prepay financial obligations.

[18] Given that direct marketing costs are exploding as the conventional direct channels (e.g. mail and outbound telemarketing) become saturated, any available efficiency in the direct marketing process is highly desirable. For example, in the marketing of home equity lines of credit (i.e. second mortgages), direct-mail response rates are now, on average, running below 0.3% (i.e. below 3/10ths of one percent). Obviously, some fraction of even this small respondent sample will prove ill-suited, as regards prepayment behavior, for the debt product being marketed. Therefore, the tailoring of specific debt products to consumers of specific prepayment behavior characteristics is essential to the efficient pricing of debt instruments. Lead generation, third-party data acquisition, underwriting, yield spread calculations all directly inform debt instrument profitability, and are all beneficially affected by the present invention.

[19] Finally, in the context of sophisticated asset liability management (ALM), subtle prepayment behavior analysis provides significant benefits to its practitioners. Because ALM, as a primary objective, seeks to minimize destructive asymmetries in asset and liability cash flows, intelligent risk managers will utilize debt contracts of varying expected durations to strengthen their balance sheet. For example, a lender's risk manager may seek multiple classes of debt instrument, reflecting multiple prepayment profiles, in order to assure himself of adequate incoming cash flow to sustain his expected liability cash outflows. In the matching, therefore, of expected cash in- and out-flows, the prudent risk manager utilizes a carefully segmented portfolio of debt instruments scored by prepayment propensities (and other measures) and priced accordingly, to avert liquidity crises.

[20] An additional, equally valuable use of the present invention is in the valuation of existing mortgage or debt instrument blocks of business. This valuation may be required by lender risk managers, auditors, regulators, or investors; it may reflect stakeholder interest in actively managing asset-liability risk, or it may be performed as part of the merger and acquisition appraisal. In all instances, the prepayment scoring system quantifies from a granular perspective upward to a pool, or block perspective, the prepayment speed characteristics of the debt instruments. As we have seen in the Green Tree case, failing to adequately price prepayment risk has enormous balance sheet implications, and typically leads one to grossly over value a portfolio or the enterprise itself.

[21] For auditors, the system of the present invention offers a quantitative measure of prepayment risk thus reducing auditor exposure to "claw-back" write-downs. This situation occurs in the case of issuers that secure these mortgages and, under the generally applied accounting procedures (GAAP) accelerate and capture earnings based on certain prepayment assumptions. If those prepayment assumptions are incorrect, prior year financial statements are incorrect and massive charges are required to reflect lower portfolio earnings.

[22] For banking regulators, the system of the present invention offers the ability to quantify balance sheet risk resulting from expected consumer prepayment behavior. This will allow regulators to more precisely measure and assign minimum bank capital levels.

[23] For credit rating agencies, the ability to score according to an objective, standard

methodology prepayment risk provides enormous assistance in rating a lender's creditworthiness. Rating agencies function, effectively, as credit market bellweathers. Lending institutions are dependent on favorable credit ratings in order to float their institutional debt at advantageous rates; rating agencies, as in the case of regulators, evaluate carefully lenders' claims of capital adequacy; the capital (cash reserves) retained by lenders is directly and immediately affected by debt instrument prepayment speeds. This is because, under GAAP accounting rules, lenders are allowed to capture a substantial percentage of the future expected profits for a given contracted debt instrument, and those profits are themselves substantially dependent on the assumed life of the instrument. (In the case of subprime mortgages, for example, profits may double if the mortgage is maintained in force for four years instead of three). If those profits are overstated, they must be reversed, with resultant charges reducing lender capital (capital: paid-in cash investments plus retained profits). Therefore, rating agencies must scrutinize lender portfolio prepayment speed assumptions, because if those assumptions prove false, then the lender will suffer a reduction in capital. Any significant impairment of lender capital necessarily suggests a reduction in its credit rating. Credit rating agencies will be major beneficiaries and users of the present invention.

- [24] For investment bankers, the system of present invention establishes a standardized prepayment methodology that allows merger and acquisition advisers to be able to quantitatively measure the balance sheet risk in a target banking or mortgage company. In addition, investment bank usage of the present invention will include its application to debt instrument securitization. Securitization describes the process

by which pools of mortgage or other debt instruments are purchased by investment banks-in their capacity as underwriters-and re-sold to institutional and public investors as reconstituted securities. Typically, these securitizations benefit originators of debt, because they realize significant acceleration in realized profits; they also significantly diversify their risks by selling significant aspects of the debt instrument to asset underwriters and others. However, the typical debt instrument securitization proceeds with the originating lender retaining significant prepayment risk; if prepayment speeds accelerate beyond levels assumed in the securitization pricing process, the originating lender is held responsible. Hence the invention, by measuring the expected prepayment behavior and scoring in according to an accepted, industry standard method, will improve the securitization process and render it more efficient. Once again, this will reduce costs for all participants and free up more capital for lower-cost consumer borrowing.

[25] For investors, the method of the present invention provides a way to make investment decisions based upon quantified debt instrument prepayment behavior risk for lending institutions in which investors might want to invest, or to evaluate the relative stability of mortgage securities that are backed by individual debt instruments.

[26] These and other advantages of the present invention are described in reference to the specification that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[27] Figure 1 is an overview of the process of the present invention.

- [28] **Figure 2** is a block diagram of the present invention.
- [29] **Figure 3** is a block diagram showing the user interface module connections.
- [30] **Figure 4** is block diagram showing the interactions with the prepayment historical data.
- [31] **Figure 5** is a block diagram showing the interactions with the econometric model.
- [32] **Figure 6** is a block diagram showing the factors that are used by the user interface module.

DETAILED DESCRIPTION OF THE INVENTION

- [33] Referring to **Figure 1**, an overview of the process of the present invention is shown. The mortgage broker or lending institution first obtains a loan application from a borrower **10**. That information is electronically transmitted to the present invention, which parses the information **12** of the loan application into various categories that are relevant to the scoring of the potential loan. The loan application contents are parsed based upon the information needs of a sophisticated, mathematical model resident in the present invention. A prepayment score is then derived **14** for the particular consumer as a function of the particular loan type being requested, and in further view of the interest rate environment in which the loan is being processed (i.e. rising or falling interest rates). As previously noted this score is an indication of the prepayment propensity of a particular consumer. The prepayment score is then returned to the lender **16**. Thereafter the lender can create a customized loan product that rewards favorable prepayment behavior of the

consumer 18.

[34] Referring to **Figure 2**, an overview of the system of the present invention is shown. A loan originator **20** receives the application from a potential consumer. That application is then input to the loan originator's data delivery channels **22**. Such data delivery channels **22** are (without limitation) e-mail, fax, Internet, and generally other electronic means. Other loan originators **34** also send their respective consumer applications over their own data delivery channels **36**.

[35] The present invention anticipates delivery of loan applications **24** over the Internet **28** or other digital electronic means such as wireless communications methods as well. Electronic loan applications **40** enter the system of the present invention through a communication server **42**. The loan information concerning a given consumer is then submitted to an application parser **52**. Application parser **52** divides the information into loan information **58** and applicant information **56**. Loan information **58** is information that relates to the amount, the term, down payment, loan type, and other information important and relating to the amount of money to be loaned. Applicant information **56** is information such as name, address, Social Security number, and other demographic information concerning the applicant.

[36] Loan information **56** is fed into a prepayment model library database **66**. The prepayment model library database **66** comprises information concerning prepayment historical data **62**. The results are fed into model training server **64** which processes prepayment historical data **62** of both an individual and demographic groups which in turn provides updates to the model library database **66**.

Once loan information 58 is processed by the prepayment model library database 66 an analytical prepayment model 60, which is based upon the loan information 58 is provided to the prepayment calculation server 46. Prepayment calculation server 46 receives additional information from econometric model 48 which establishes the relationship among the wide variety of variables. Econometric model 48 generates interest rate, mortgage rate and other economic parameters that, arrayed in time series, comprise scenarios utilized by the prepayment calculations server. These scenarios are generated from the Low Discrepancy Sequence (LDS) logic, rather than using random number generation. The LDS logic affords significantly higher model accuracy with the same number of scenarios.

[37] Once a prepayment score 44 is derived by prepayment calculation server 46, prepayment score 44 is sent to the communication server 42 and is transmitted over the Internet (or other electronic channels) 28 through the data delivery channels 22 or 36 back to loan originators 20 or 34 who can then either approve, disapprove, or create customized loan product for the consumer.

[38] Prepayment score 38 is calculated based upon the following model. The specific prepayment analysis of the present invention is conceptually shown below.

[39] The following variables:

[40] $A = (a_1, a_2, \dots, a_n)$

[41] $L = (l_1, l_2, \dots, l_m)$

[42] are vectors of the applicant's data and loan parameters.

[43] $E_s(t) = (e_{1s}(t), e_{2s}(t), \dots, e_{ks}(t)); \quad s = 1, \dots, S$

[44] denotes a set of Low Discrepancy Sequence (LDS)-based scenarios of the econometric parameters, which have been generated by the RTH Linked Index Econometric Model. Thus the model is a set of stochastic differential equations that describe the dynamics and interaction of major macroeconomic indicators, each relevant to the prepayment propensity calculation.

[45] Analytical Prepayment Model \mathfrak{R} , which varies with the types of loan applied for, is trained to calculate prepayment value p_s in a given scenario based on the applicant's data (A), loan parameters (L), and econometric parameters (E):

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

[46] Total prepayment, accumulated by the time T in scenario s , can be calculated as:

$$P_s(T) = \prod_i p_s(t_i)$$

[47] Then, total prepayment at time T is given by:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

[48] Finally, the prepayment score is:

$$Score = \sum_T TP(T)$$

[49] The analytical model that produces the prepayment score may be further informed

by additional external behavioral or econometric factors, based on subsequent research, as well as the aforementioned behavioral scoring of mortgage broker behavior.

[50] The present invention may also be represented in an alternative embodiment in the form of the credit engineering workstation (CEW). This CEW (more fully described below) comprises a user interface which allows a loan originator to conduct all of the prepayment calculations, model analysis, and pricing of the present invention using the prepayment model first noted above.

[51] The CEW operates in either a Unix or Windows NT environment using Oracle, SQL server, Sybase, DB2, or Informix database support. The CEW also uses CORBA or, structured object models together with a JAVA/HTML browser based graphical user interface.

[52] The subroutines of the CEW all contribute to the end goal of determining the prepayment propensity of a consumer. For example, subroutines of the present invention deal supports the generation of various interest rate scenarios, and subsequent economic scenarios model fitting processes that fit the modeled interest rates scenarios to historical and current interest rate yield curve performance as well as to other macro economic indicators.

[53] Part of the system includes rewards pricing logic to efficiently measure and price the impact of rewards on consumer prepayment behavior. For example it would be most beneficial to a lender to reward the consumer for not prepaying the lender's loan. Such a reward could be assessed in terms of its impact on the consumer

prepayment behavior. The system therefore permits the end-user to design pro forma rewards structures and to test their impact on prospective consumer prepayment behavior.

[54] Various user definable screens also establish default spreads, prepayment spreads, broker commission schedules, and other financial factors that influence the pricing of the product to be offered to the consumer. Various other economic scenarios are collected via the user interface and combined with various probabilities and default data as well as other lender defined criteria result in rationally priced end-user mortgage contracts.

[55] Referring to **Figure 3**, further information concerning the CEW of the present invention shown. The system comprises user interface module **70** which is the basic graphical user interface and other software that allows an originator to provide information concerning a consumer who wishes to borrow money from lender. The user interface module allows the collection of loan attributes **76**, applicant attributes **74**, and reward program attributes **72**. In addition user interface module **70** collects or calculates spreads, broker commissions and other costs associated with the loan **78**. Loan attributes **76** and other loan related costs are fed into pricing engine **84** which, with other information, assists in creating an appropriate loan price **86**.

[56] Loan attributes **76**, applicant attributes **74**, and reward program attributes **72** all which have an impact on the value of the loan are fed into prepayment calculation server **80**. Prepayment calculation server **80** receives input from the various prepayment model parameters and creates prepayment score **82**.

- [57] Referring to **Figure 4**, a block diagram showing the interactions which are necessary to create a prepayment model are shown. Consumer information **96** which consists of applicant attributes **74** and loan attributes **76** are fed into a prepayment model fitting **92** module. Prepayment model fitting **92** establishes various prepayment model parameters **94** based upon prepayment historical data **90**. Once the appropriate prepayment model is created by prepayment model fitting **92**, a model is returned to the prepayment calculation server for the calculation of the prepayment score of the particular consumer given the type of loan to consumer is requesting. The prepayment calculation server also benefits from input from an econometric model scenario generator.
- [58] Referring to **Figure 5**, the interactions for the econometric model are shown. Econometric model scenario generator **106** receives input from econometric model fitting module **104** and LDS scenarios **108**. Econometric model fitting module **104** receives information from econometric historical data **100** and current market environment **102** which comprises, without limitation, information concerning rising or falling interest rates and trends. The information from econometric historical data **100** concerns the demographic group to which the consumer belongs and other econometric information such as age, income, credit rating, occupation and other factors. The information from current market environment **102** concerns the direction and velocity of changes to interest rates. Econometric model scenario generator **106** processes the information and produces various scenarios based on the information.
- [59] Referring again to **Figure 3**, prepayment calculation server **80** creates prepayment score **44** for the particular consumer in question. Prepayment score **44** is based upon

the established prepayment model and the generated econometric model.

Prepayment score 44 is transmitted to the pricing engine 82 to establish the pricing of the loan product to be offered to the consumer in question.

[60] Referring to **Figure 6**, additional parameters which the user interface module uses to create the various scenarios are shown. Additional aspects of the present invention provide for creation of new products. Strategy optimizer 122 is based upon acceptance of offered products by consumers and input from and relating to other products are on the market. Strategy optimizer 122 generates marketing plans based upon individual lenders' portfolios. Such a market plan could assist the lender in offering new products to the marketplace that are more profitable for the lender. The system includes targeting optimizer 124 which provides a way to offer loan products to those consumers having the most favorable prepayment characteristics, i.e., a low propensity to prepay loans made. The system also comprises loyalty optimizer 126 which models and defines offers and other inducements to consumers to reward financially advantageous consumer behavior. Channel optimizer 128 is part of the present invention. Channel optimizer 128 analyzes the channels of delivery of financial product offerings to evaluate and determine the channel that is the most efficient way to deliver various financial products. The system also comprises database optimizer 130 which receives and organizes information in the various databases to constantly build and refined prepayment historical data 90 and econometric historical data 100.

[61] The target platform on which the system of the present invention will run is either an Intel Pentium processor based system with typically 32 megabytes of RAM, hard

disk storage and retrieval, and communications capability using the TCP/IP protocol. Alternatively the system will also run under the UNIX operating system on a Sun Solaris platform. In both cases displays for users are anticipated as is the ability to output hard copy reports. In typical operation, a plurality of users, remote from the system site will access the system via private networks or over the Internet to send the information necessary for the present invention to make the desired calculations leading to the prepayment score. This score is then sent back to the requesting user at the remote terminal.

[62] Although described herein with respect to a mortgage loan or loan, the present invention is applicable to numerous financial instruments that have a value that depends on the particular consumer's actions over time. The value of typical debt instruments, such as, but not limited to, mortgages, second mortgages, home equity loans, car loans, school loans, term loans, leases, credit card accounts, and credit card balance transfers, depend on a continued stream of cash and are therefore affected significantly by prepayment.

[63] The value of other instruments that depend on the cash stream over time, such as open-end car leases and whole-life insurance policies, can also depend on the consumer's actions, and therefore, for purposes of this invention can be considered as a form of debt instrument. In the car lease scenario, predicting the probability of a consumer electing to purchase or return the car before the end of the lease (prepay) is important in determining the value of the lease. Even a consumer's predisposition to keeping (purchasing at residual value price, a type of prepayment) or returning the car at the end of the lease can be used to modify the lease terms to the leasing entity's

advantage.

[64] Likewise, the likelihood of a consumer to cash out the surrender value of a whole-life insurance policy (another form of prepayment, albeit in the opposite direction, that ends the stream of cash) can significantly affect the ultimate value of the policy to the insurer.

[65] Known database and computer-based data mining techniques can be used for analyzing: the value of financial instruments (and portfolios in which they are packaged) based on the prepayment score associated with each of them; the risk associated with portfolios containing the financial instruments; and the pricing for servicing those portfolios. Additionally, instruments can be packaged together into portfolios based, at least in part, on the prepayment scores of the applicants.

[66] A system and method for prepayment score generation has been described. Those skilled in the art will appreciate that other variations of the present invention are possible without departing from the scope of the invention as described.

WHAT IS CLAIMED IS:

[c1] A system for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:

at least one debt instrument origination computer terminal for accepting and transmitting a debt instrument application of an individual applicant;

a computer network connected to the at least one debt instrument origination computer terminal for receiving the transmitted debt instrument application of the individual applicant;

a communication server connected to the computer network for receiving the transmitted debt instrument application of the individual applicant;

an application parser connected to the communications server for receiving the transmitted debt instrument application of the individual applicant from the communications server and parsing the information into debt instrument information and applicant information;

a prepayment model library database comprising debt instrument prepayment models connected to the application parser for receiving the debt instrument information and fitting the debt instrument information into the debt instrument prepayment models and for transmitting debt instrument prepayment models that match the debt instrument information; and

a prepayment calculation server comprising a prepayment score generation model connected to the prepayment model library database for receiving the debt instrument

prepayment models and calculating a prepayment score for the debt instrument application of the individual applicant based upon the debt instrument prepayment model and the prepayment score generation model, the prepayment calculation server being further adapted to transmit the prepayment score to at least one debt instrument origination computer terminal via the communications server and the computer network;

where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment; and

wherein the at least one debt instrument origination computer terminal is adapted to use the prepayment score to adjust terms of the debt instrument of the individual applicant.

[c2] The system for determining a prepayment score of claim [c1], where the prepayment model library database further comprises:

a model training server for creating the debt instrument prepayment models for the prepayment model library database; and

prepayment historical data storage means connected to the model training server, the prepayment historical data further comprises prepayment statistics regarding debt instruments of various types.

[c3] The system for determining a prepayment score of claim [c1], where the prepayment calculation server further comprises an econometric model that

generates Low Discrepancy Sequence (LDS)-based scenarios of econometric parameters for input to the prepayment calculation server.

- [c4] The system for determining a prepayment score of claim [c1], further comprising means adapted to calculate a total prepayment at time T from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

- [c5] The system for determining a prepayment score of claim [c4], further comprising means adapted to calculate the total prepayment, accumulated by time, in scenario s from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

- [c6] The system for determining a prepayment score of claim [c5], further comprising means adapted to calculate the prepayment value in a given scenario from the formula:

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \mathfrak{R} is an analytical prepayment model.

[c7] The system for determining a prepayment score of claim [c1], where the applicant is either an individual consumer or an individual household.

[c8] The system for determining a prepayment score of claim [c1], further comprising computer-based means for using data associated with the prepayment score of the applicant and terms of the debt instrument to determine a calculation selected from the group consisting of: a value of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c9] A method for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:

collecting debt instrument and applicant information at a debt instrument originator;

transmitting the debt instrument and applicant information over a network;

receiving the debt instrument and applicant information at a service bureau;

the service bureau calculating a prepayment score the individual applicant, where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment;

the service bureau returning the prepayment score over the network to the debt

instrument originator; and

the debt instrument originator using the prepayment score to customize a debt instrument product for the individual applicant.

[c10] The method for determining a prepayment score of claim [c9], where calculating a prepayment score for the applicant comprises parsing the information into debt instrument information and applicant information.

[c11] The method for determining a prepayment score of claim [c10], further comprising providing the applicant information to a prepayment model library database and the debt instrument information to a prepayment calculation server.

[c12] The method for determining a prepayment score of claim [c11], further comprising the prepayment model library determining the prepayment model that best applies to the debt instrument information and providing that prepayment model to the prepayment calculation server.

[c13] The method for determining a prepayment score of claim [c12], further comprising the prepayment calculation server receiving a prepayment model and an econometric model, where the prepayment calculation server further calculates a prepayment score for the applicant.

[c14] The method for determining a prepayment score of claim [c13], where the total prepayment at time T is calculated from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

[c15] The method for determining a prepayment score of claim [c14], where the total prepayment, accumulated by time, in scenario s is calculated from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

[c16] The method for determining a prepayment score of claim [c15], where the prepayment value in a given scenario is calculated from the formula:

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \mathfrak{R} is an analytical prepayment model.

[c17] The method for determining a prepayment score of claim [c9], where the applicant is defined as an individual consumer or an individual household.

[c18] The method for determining a prepayment score of claim [c9], further comprising rating a broker based on prepayment scores of applicants that are clients of said broker.

[c19] The method for determining a prepayment score of claim [c9], further comprising using the prepayment score of the applicant and terms of the debt instrument to assist in determining a calculation selected from the group consisting of: a value

of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c20] The method for determining a prepayment score of claim [c9], further comprising packaging said debt instrument into a portfolio based, at least in part, on the prepayment score of the applicant.

Abstract of the Disclosure

A method and apparatus is disclosed for determining the prepayment propensity of individual borrowers. Early payment of debt instruments, such as loans and leases, can lead to losses being suffered by lenders. The present invention analyzes the demographics associated with a particular borrower to determine both the individual and group based prepayment propensity. The history of the borrower, the history of the borrower's demographic group, interest rate trends and other factors are then used to calculate a prepayment score that can be used by the lender to determine the propensity of a given borrower to prepay the instrument in question. The score of the individual borrower can be used to estimate the profitability of a debt instrument and allow the lender to make appropriate adjustments prior to issuing the instrument. The individual prepayment scores of a lender's or broker's clients can also be used to rate the lender or broker.

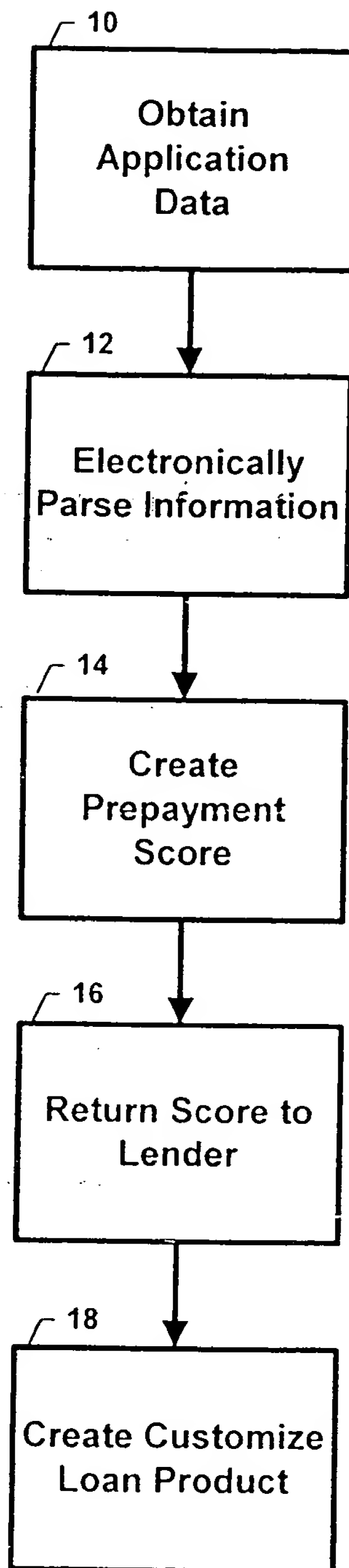


FIGURE 1

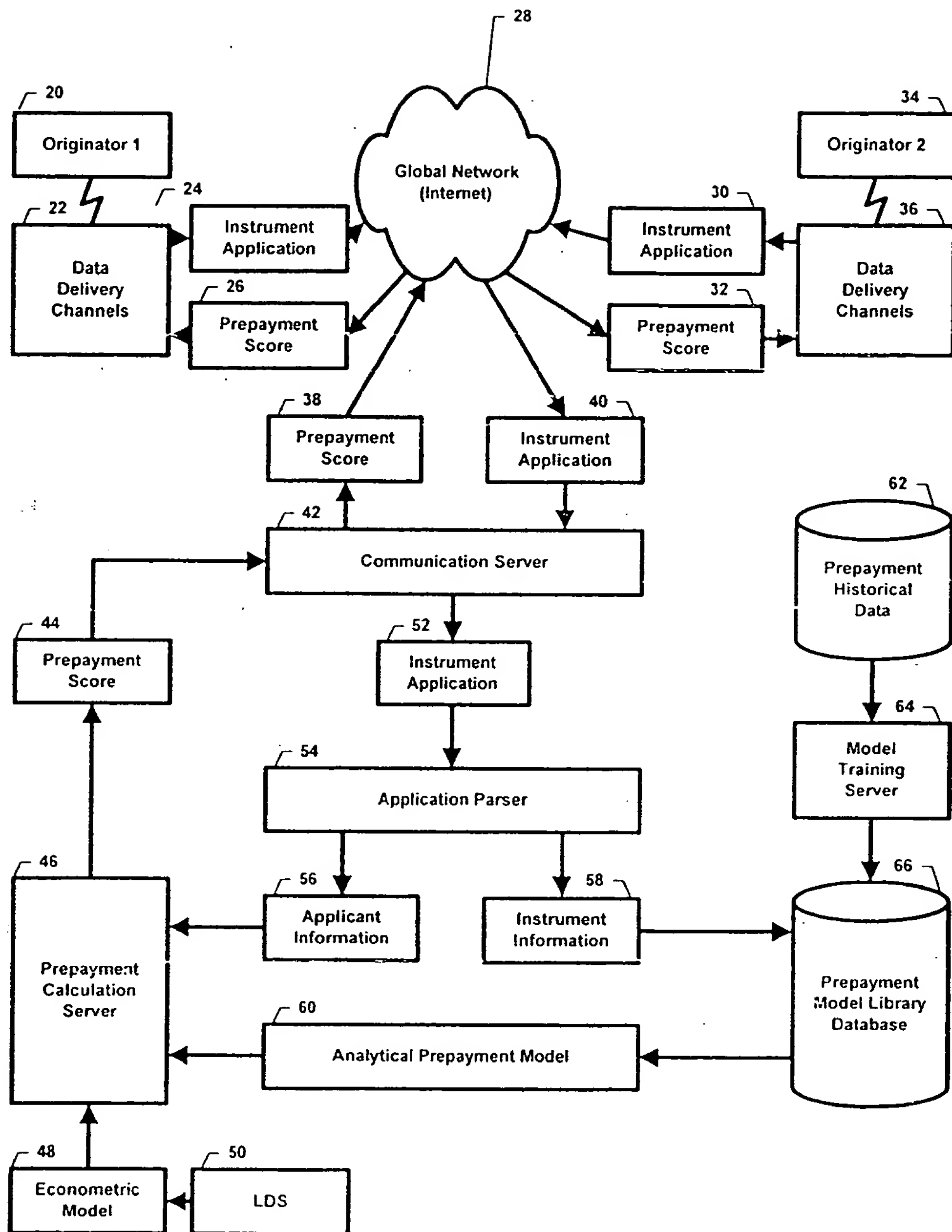
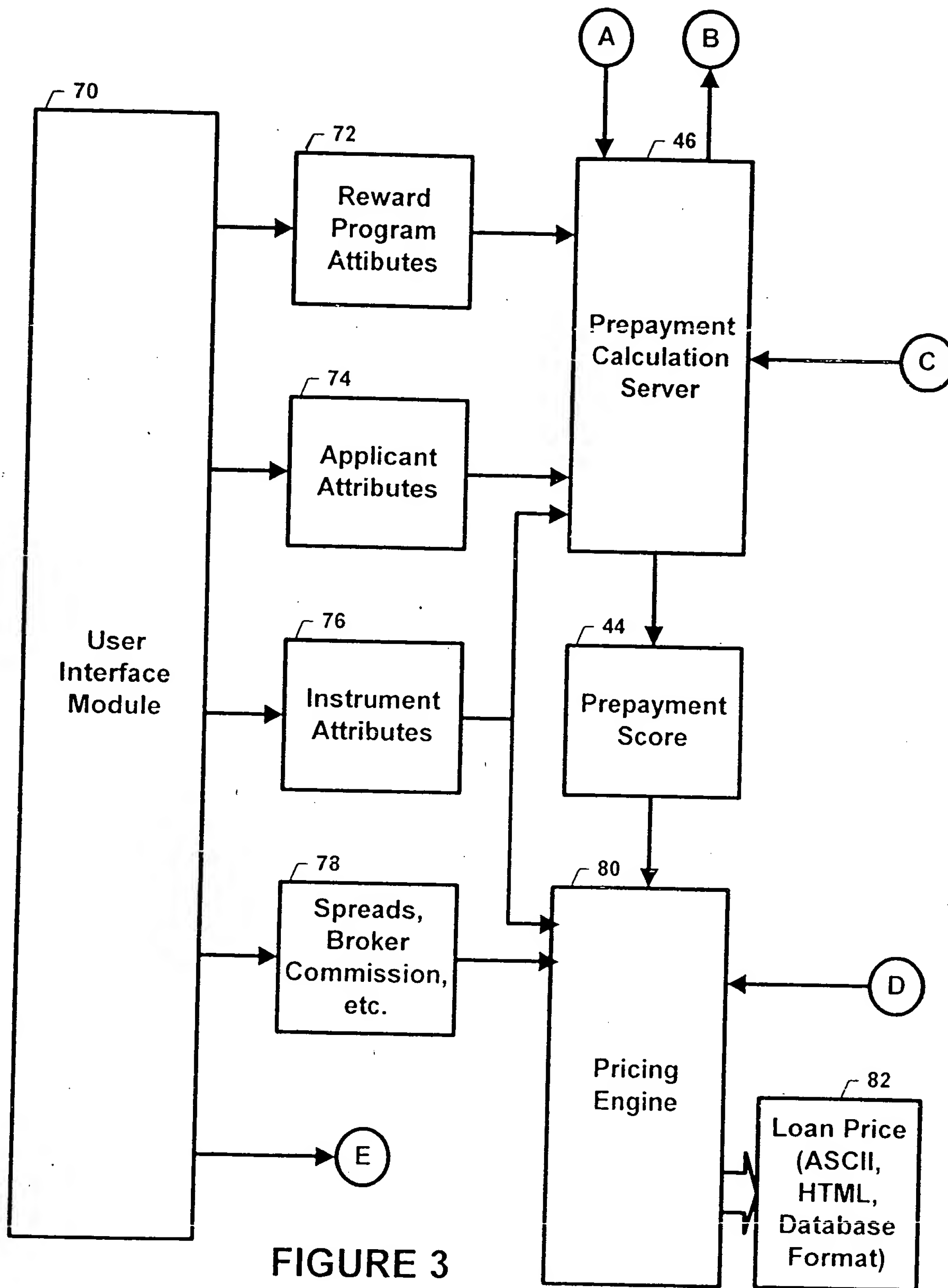


FIGURE 2



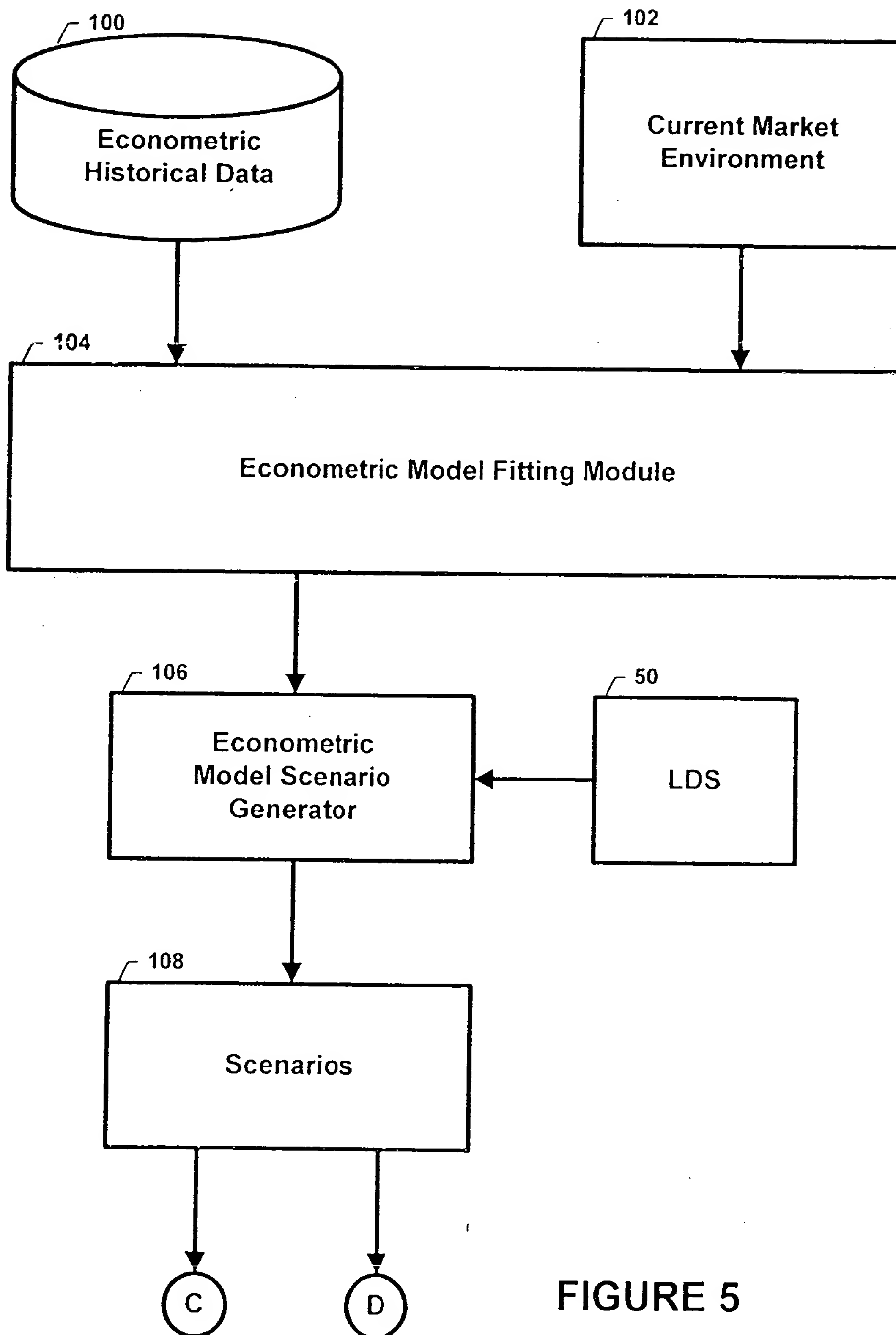


FIGURE 5

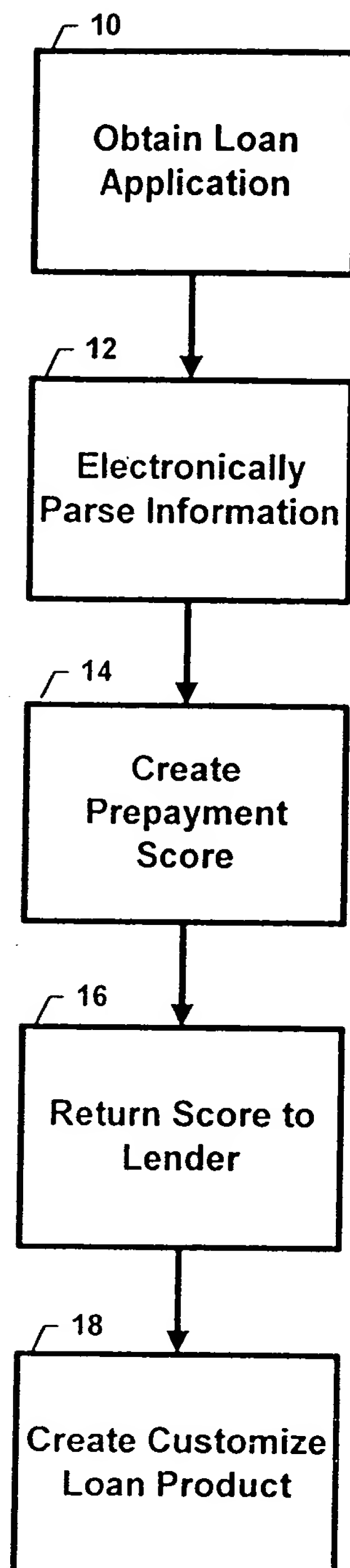


FIGURE 1

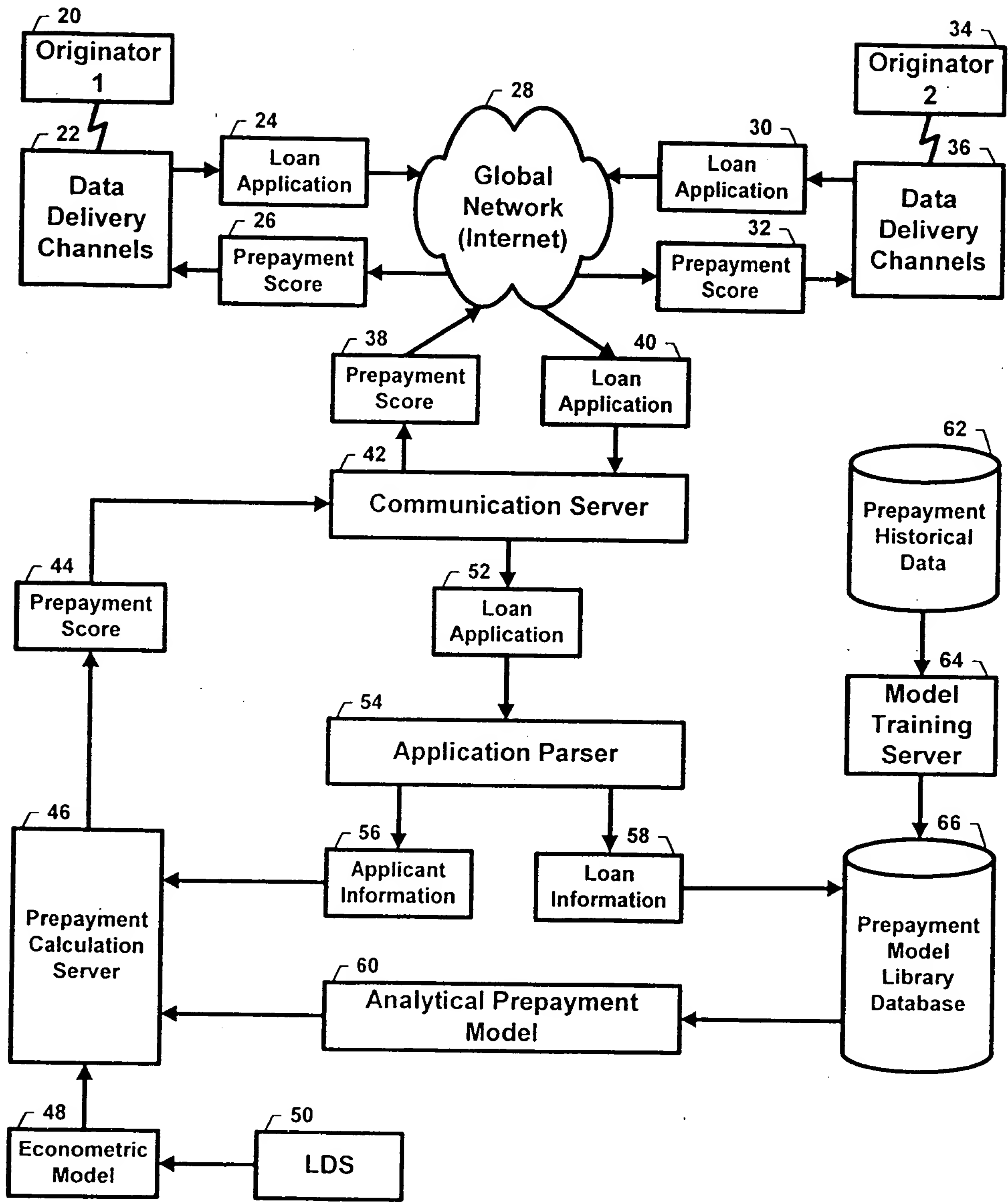


FIGURE 2

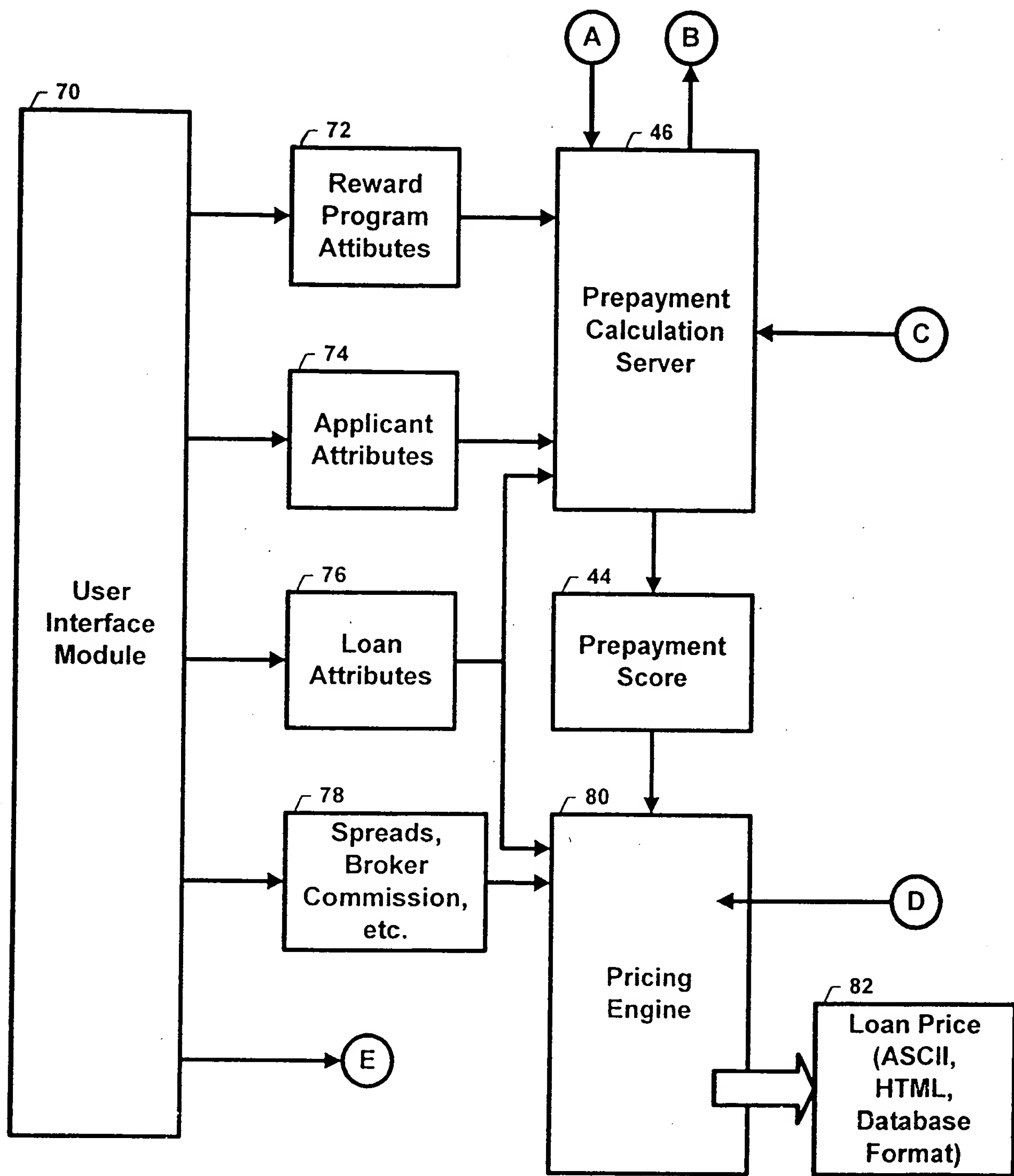


FIGURE 3

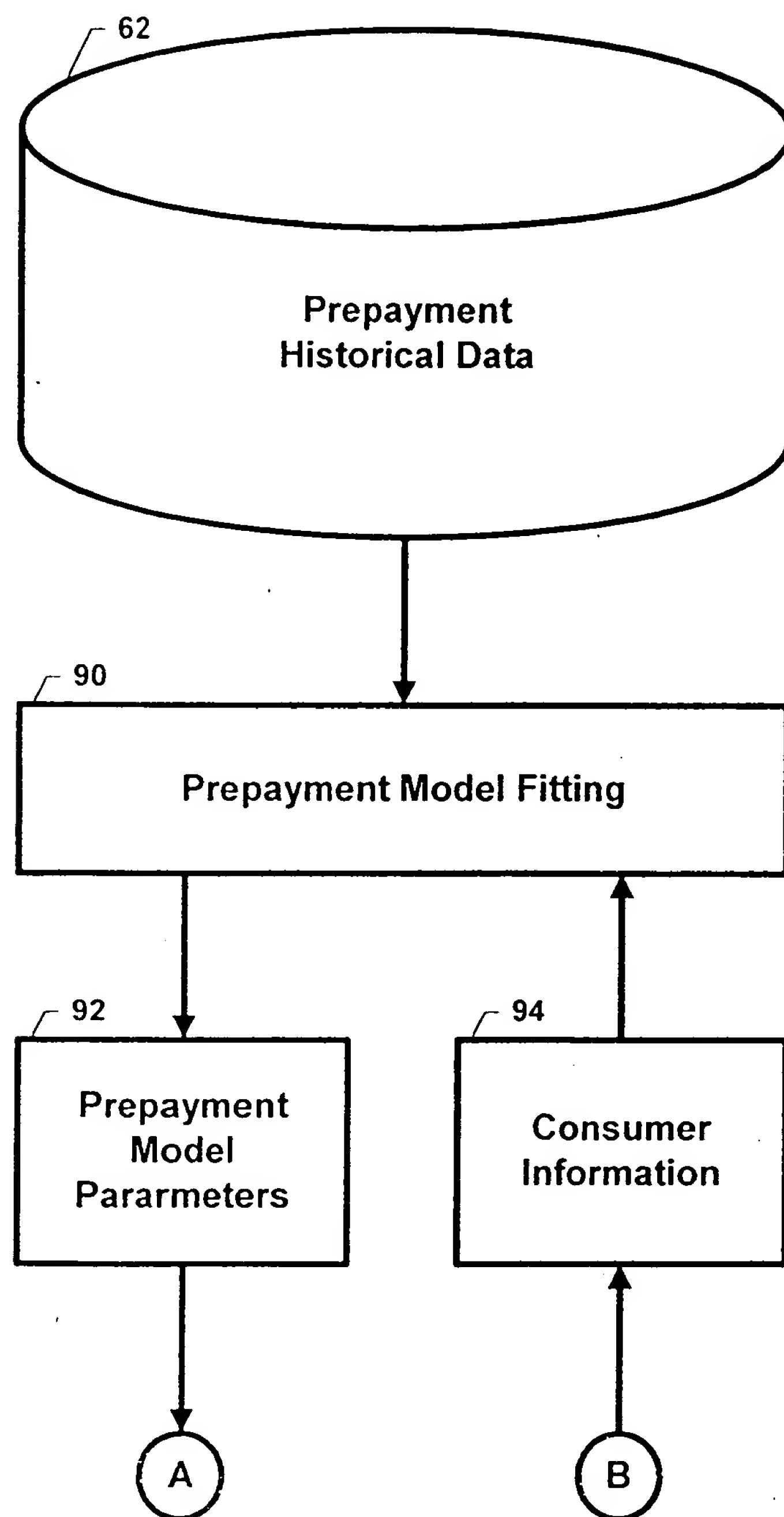


FIGURE 4

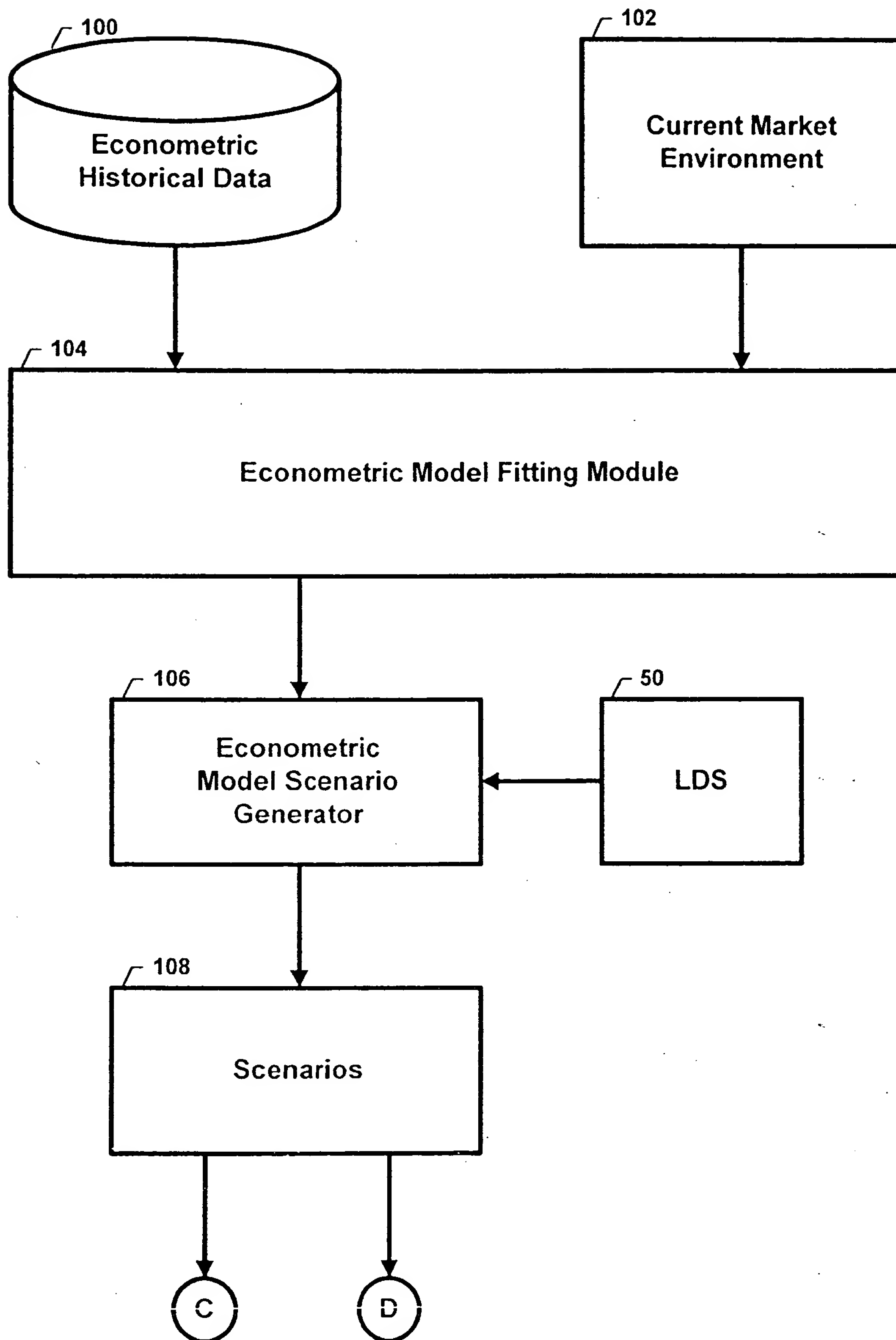


FIGURE 5

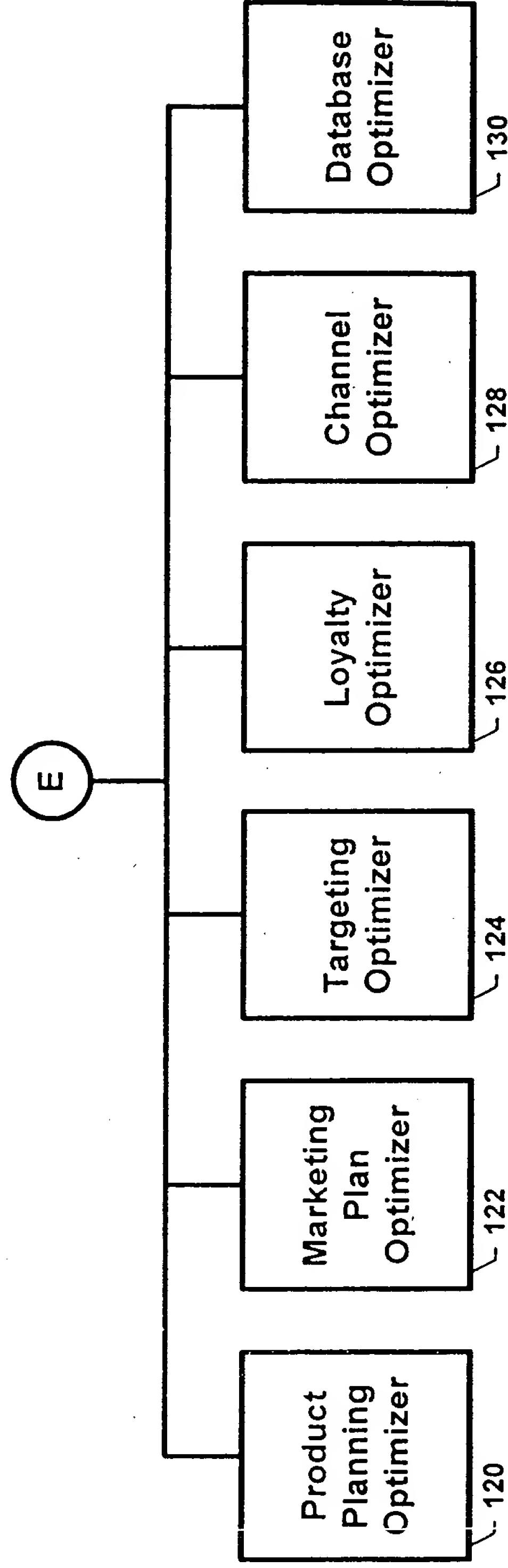


FIGURE 6

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Yuri Galperin, et al.
Appl. No.	:	09/942,983
PCT Filing Date	:	August 30, 2001
For	:	METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT
Examiner	:	Siegfried E. Chencinski
Group Art Unit	:	3692

STATEMENT OF CHARLES L. JONES III UNDER 37 C.F.R. § 1.48(a)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Charles L. Jones III, do declare as follows:

1. I am a citizen of the United States and reside at _____.
2. The above-referenced patent application was filed on August 30, 2001 listing Yuri Galperin, Vladimir Fishman and William A. Eginton as the joint inventors.
3. I believe that I, Charles L. Jones III, should also be named as an inventor in the above-referenced application.
4. The inventorship error occurred without deceptive intent on my part.

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or document, or any registration resulting therefrom.

Dated: _____

Charles L. Jones III

ASSIGNMENT

WHEREAS, I, Charles L. Jones III, residing at _____, am a joint inventor, along with Yuri Galperin, Vladimir Fishman, and William A. Eginton, of certain new and useful improvements in a METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT for which we have filed an application for Letters Patent in the United States, Application No. 09/942,983 Filed on August 30, 2001;

AND WHEREAS, MarketSwitch Corporation (hereinafter "ASSIGNEE"), a Delaware corporation, with its principal place of business at 2350 Corporate Park Drive, Suite 400, Herndon, VA 20171, desires to acquire the entire right, title, and interest in and to said improvements and said Application:

NOW, THEREFORE, in consideration of the sum of One Dollar (\$1.00) to me in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, I, said inventor, do hereby acknowledge that I have sold, assigned, transferred and set over, and by these presents do hereby sell, assign, transfer and set over, unto said ASSIGNEE, its successors, legal representatives and assigns, the entire right, title, and interest throughout the world in, to and under said improvements, and said application including all provisional applications relating thereto (including but not limited to U.S. Provisional Application No(s). 60/228,954, filed August 31, 2000 (respectively if plural applications)), and all divisions, renewals and continuations thereof, and all Letters Patent of the United States which may be granted thereon and all reissues and extensions thereof, and all rights of priority under International Conventions and applications for Letters Patent which may hereafter be filed for said improvements in any country or countries foreign to the United States, and all Letters Patent which may be granted for said improvements in any country or countries foreign to the United States and all extensions, renewals and reissues thereof; and I hereby authorize and request the Commissioner of Patents of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents on applications as aforesaid, to issue all Letters Patent for said improvements to said ASSIGNEE, its successors, legal representatives and assigns, in accordance with the terms of this instrument.

AND I DO HEREBY sell, assign, transfer, and convey to ASSIGNEE, its successors, legal representatives, and assigns all claims for damages and all remedies arising out of any violation of the rights assigned hereby that may have accrued prior to the date of assignment to ASSIGNEE, or may accrue hereafter, including, but not limited to, the right to sue for, collect, and retain damages for past infringements of said Letters Patent before or after issuance.

AND I HEREBY covenant and agree that I will communicate to said ASSIGNEE, its successors, legal representatives and assigns, any facts known to us respecting said improvements, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuing and reissue applications, make all rightful oaths and generally do everything possible to aid said ASSIGNEE, its successors, legal representatives and assigns, to obtain and enforce proper patent protection for said improvements in all countries.

IN TESTIMONY WHEREOF, I hereunto set my hand and seal this _____ day of _____, 20__.

Charles L. Jones III

STATE OF }
 } ss.
COUNTY OF }

On _____, before me, _____, notary public, personally appeared **Charles L. Jones III** personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged to me that he executed the same in his authorized capacity(ies), and that by his signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

[SEAL]

Notary Signature

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature _____

Date _____

Residence: _____

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Full name of Second inventor: **Vladimir Fishman**

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Date _____

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Full name of Third inventor: **William A. Eginton**

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Full name of Fourth inventor: **Charles L. Jones III**

Inventor's signature _____

Date _____

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Charles L. Jones III
4570 Old Post Road
Charlestown, RI 02813-2560

Re: Patent Application for Prepayment Score
Application No. 09/942983
Our Reference: EXP.046A

Dear Mr. Jones:

As you know, a patent application for your invention entitled METHOD AND APPARATUS FOR DETERMINING LOAN PREPAYMENT SCORE was filed on May 15, 1998 and assigned Application No. 09/078,867, which is now issued Patent No. 6,185,543. You, Yuri Galperin, Vladimir Fishman and William A. Eginton were listed as inventors on this application. A later related application was filed on August 30, 2001 and assigned Serial No. 09/942,983, but did not include you as an inventor. It is our understanding that you were erroneously left off this application through no deceptive intent on your part.

Therefore, we are filing a Petition with the U.S. Patent Office to correct inventorship on the related application. In order to correct inventorship we need you to sign a declaration acknowledging that you and the other three inventors are the inventors of this application. In addition, you need to sign a Statement indicating that you were erroneously left off this application through no deceptive intent on your part ("Statement").

I have enclosed a copy of the application as filed (including the specification, drawings and claims), the Statement and an Assignment of the invention to Marketswitch. Please review the application to confirm that you should be added as an inventor.

Charles L. Jones III

April 8, 2008

Page -2-

• I have previously sent you other copies of the same documents that I have enclosed in this letter, but I have not received a response. Please respond to this letter as soon as possible so that we can promptly correct inventorship in the application.

After your review, please sign and promptly return to me the Declaration, the Statement, and the Assignment in the pre-addressed envelope.

If you have any questions or if you would like to discuss this matter, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Ted M. Cannon", with a stylized, flowing script.

Ted M. Cannon

Enclosures

4961618

SPECIFICATION

TITLE: METHOD AND APPARATUS FOR DETERMINING A
PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT

RELATED APPLICATIONS

- [01] This application claims the benefit of Provisional Application Serial No. 60/228,954, filed August 31, 2000, which is incorporated herein in its entirety.

FIELD OF THE INVENTION

- [02] This invention relates generally to receiving applications for and processing of lending transactions. More specifically this invention provides a method and apparatus to assess the prepayment propensity of a borrower in the form of a prepayment "score" to enable assessment of (i) the value of mortgages, second mortgages, home equity loans or other debt instruments for investors, (ii) the value of credit card accounts and balance transfers, (iii) the value of term loans and leases, (iv) the behavior of brokers with respect to churning, (v) the valuation of existing portfolios, (vi) the risk management of institutions that hold debt instruments, and (vii) the pricing of mortgage portfolio servicing contracts.

BACKGROUND OF THE INVENTION

- [03] By way of an introductory example, consider the most common of debt instruments, the consumer mortgage. The value of a mortgage depends, in large part, on the duration of the mortgage. At the inception of the mortgage there are broker

fees and various other settlement costs that are charged to the lender. When a mortgage extends for the term of many years, there is an opportunity for the lender to recoup costs of putting a mortgage in place for a given consumer and to make profit on that mortgage. This is particularly important for all business organizations that lend money, but it is particularly important for those mortgage financing organizations which have stockholders and other investors.

[04] When a mortgage loan is paid off early due to refinancing, depending upon how early in the term, the mortgage loan is paid off, there is the possibility that the lending institution can actually take a loss on the particular mortgage. The rate of prepayment depends on a number of objective factors. For example, during times of decreasing mortgage rates, on average, more consumers refinance their home loans than would otherwise occur, in order to obtain a lower monthly payment. However, for a given macroeconomic environment and other measurable, objective factors, each consumer evidences an individual propensity to prepay a loan. This prepayment propensity reflects the consumer's demographic and other objective attributes. A system that can assess such individual prepayment behavior by a consumer in advance of the loan will lead to more profitable loans being made, and hence the enhanced availability of funds for loans to more consumer-borrowers. The present invention therefore may be applied, without limitation, to a) the pricing of mortgages and other debt instruments, b) the valuation of existing portfolios of debt instruments, and c) the risk management of institutions that hold debt instruments.

[05] Additionally, the present invention is not limited to the type of debt instrument or lending transaction to which the prepayment score is useful. The invention includes,

but is not limited to, mortgages (consumer and commercial), second mortgages, refinanced mortgages, consumer loans, commercial loans, asset-backed loans, consumer leases, commercial leases, credit card accounts, credit card balance transfers, debt consolidation loans (term notes, etc.), mortgage-backed securities (i.e., mortgage pass through, CMO's, mortgage-backed bonds, principal-only, interest-only, etc.), and any servicing contract for these lending transactions that performs financially based on the quality (i.e., duration) of the cash flow.

[06] A further element of the present invention is the monitoring and scoring of brokers for these lending transactions. Mortgage brokers deal with both consumer-borrowers and lenders-clients. In order to generate brokerage fees, it is possible for a broker to encourage its consumer-borrowers to refinance their mortgages frequently and prematurely. When this occurs, the mortgage broker generates a fee for the broker, however, early prepayment of the prior mortgage instrument can result in a loss for the lender. Thus the present invention also has the capability to score mortgage broker prepayment behavior.

[07] The behavior of a broker is sometimes not all heinous. Sometimes a consumer, who is particularly attuned to the rise and fall of interest rates, will simply be the one who changes mortgage instruments more frequently than the average consumer. The broker who is scored based upon the prepayment behavior of the consumers that the broker brings to lenders, would like to know the pre-payment propensity for the given consumer. This would be useful so that the mortgage broker can optimize the broker's relationship with its lender-clients by only bringing consumer-borrowers who have a low prepayment propensity.

[08] Therefore, lenders and brokers badly need the ability to better measure prepayment behavior in advance of incurring marketing or underwriting charges; these expenses are too great to absorb blindly on behalf of consumers with poor prepayment propensities. Indeed, a beneficial use of the invention would be in managing the initial marketing effort itself. For example, only those customers who can be shown to score favorably for prepayment behavior might receive a solicitation for a mortgage product A. Consumers who are revealed to represent a substantial prepayment risk may be offered a more suitable mortgage product B, reflecting the increased risk. In this way, enhanced customers segmentation and product design initiatives converge to benefit consumers and their sources of debt financing, to the benefit of each.

[09] To understand the potential impact of national prepayment scoring standard, as manifested in the present invention, one need look no farther than the existing default risk scoring standard, owned and distributed by Fair, Isaac and Company, Inc. (Fair Isaac) for over 30 years. By establishing a standard methodology for scoring borrower default risk, and broadly disseminating it, Fair Isaac dramatically enhanced mortgage lender insight into expected loan dynamics. In finance, enhanced insight is synonymous with enhanced information. Enhanced information implies reduced risk for the lender. Finally, reduced lender risk profiles produce lower costs of capital. In other words, because Fair Isaac standardized successfully a fungible measurement of default risk, more money is available for consumers to borrow, at better and cheaper interest rates. The market is more efficient than before and everyone benefits.

[10] To further qualifying the timeliness of the invention, please refer to exhibit 1, "Green Tree chief returns \$23 million..." The Wall Street Journal, March, 1998. This story highlights the industry wide uncertainty surrounding prepayment speeds in consumer debt portfolios. One industry leading company, Green Tree Financial, "has been hit hard the past year by escalating loan losses in the painful recognition that its accounting has been too aggressive. Also, an unexpected wave of loan prepayments hit the industry, as borrowers sought lower interest rates, indicating working-class consumers were not as unsophisticated as lenders had believed." Stated plainly, Green Tree overstated prior year earnings significantly, exercising its option under GAAP accounting to roll forward and capture in advance projected lending profits, even though those very profits were merely estimated based in part on arbitrary prepayment assumptions. In large measure because Green Tree badly miscalculated these prepayments speed assumptions, in 1997 the company was forced to charge off \$390 million of 1996 reported profit. In 1998 the company was sold off to Consec.

[11] Earlier disclosures in the area of prepayment scoring in a lending context are limited or nonexistent. United States Patent No. 5,696,907, entitled "System and Method for Performing Risk and Credit Analysis of Financial Service Applications," issued to Tom. The Tom patent discloses using a neural network to mimic a loan officer's underwriting decision making. The method of the Tom patent is based on a non-iterative regression process that produces an approval criterion that is useful in preparing new or modified underwriting guidelines to increase profitability and minimize losses for a future portfolio of loans. A prepayment observation is used in the neural net as a negative flag, but no prepayment scoring system is utilized in the

Tom patent.

- [12] In view of the prior art, there is a clear need for measuring and predicting a consumer's prepayment propensity, as well as a clear and strong need for a method and apparatus to produce such a measuring and predictive parameter.

BRIEF SUMMARY OF THE INVENTION

- [13] The system and method of the present invention generally works in the following manner: the service bureau or broker will electronically capture individual loan applications from consumers. Those loan applications will be sent to lenders for evaluation. The lender, using the present invention submits the loan application for review and analysis. The loan application will be reviewed by the present invention according to a sophisticated economic and customer behavior model, which will score the prepayment behavior of candidate borrowers. The score for these borrowers, which is an index of their prepayment propensity, will be electronically returned to the lender. The lender will in turn use the prepayment score and calibrate an appropriate mortgage price including the setting of interest rates, fees, broker commissions, and potentially consumer rewards. Using this consumer scoring technique, a lending institution can seek to contact or contract with those consumers who display a low propensity to prepay.

- [14] The advanced scoring of customer prepayment propensities materially improves the lender's to risk profile as regards new lending customers. This novel insight adds value to the marketing, underwriting, lending, administrative process for first and second mortgages, credit card balance transfers, and asset-backed term loans such as

automobile loans. By assisting lenders in their efforts to segment customers according to this crucial behavior metric, waste and excess costs are driven from the lending economy. More money is thus available, more cheaply, for more people.

[15] To the borrower, this system offers several advantages. First, more favorable loan terms can be made to those consumers who exhibit a beneficial borrowing behavior, i.e., borrowers who are not likely to prepay their loans but instead maintain their loans for a profitable duration. Further, dealing with a stable borrower market results in a more favorable financial environment on for all lenders thereby mitigating the risk of loss and, in the normal course of all efficient markets, passing that financial advantage onto borrowers generally.

[16] Once again, the irrefutable economic relationship between financial risk-taking and expected financial reward informs the environment addressed by the present invention. If lenders reduce their risks-and by extension their costs-through enhanced prepayment scoring, ultimate borrowing costs paid by consumers will decline.

[17] For the loan originator, the system offers several advantages. The loan originator can more efficiently price the particular loan. Further the loan originator can more efficiently select brokers and intermediaries who will select the best borrowers. Further, the system and method of the present invention will lead to more efficient direct and indirect marketing investments by identifying individual consumers and groups of consumers who exhibit the most beneficial borrowing behavior, i.e., a propensity not to prepay financial obligations.

[18] Given that direct marketing costs are exploding as the conventional direct channels (e.g. mail and outbound telemarketing) become saturated, any available efficiency in the direct marketing process is highly desirable. For example, in the marketing of home equity lines of credit (i.e. second mortgages), direct-mail response rates are now, on average, running below 0.3% (i.e. below 3/10ths of one percent). Obviously, some fraction of even this small respondent sample will prove ill-suited, as regards prepayment behavior, for the debt product being marketed. Therefore, the tailoring of specific debt products to consumers of specific prepayment behavior characteristics is essential to the efficient pricing of debt instruments. Lead generation, third-party data acquisition, underwriting, yield spread calculations all directly inform debt instrument profitability, and are all beneficially affected by the present invention.

[19] Finally, in the context of sophisticated asset liability management (ALM), subtle prepayment behavior analysis provides significant benefits to its practitioners. Because ALM, as a primary objective, seeks to minimize destructive asymmetries in asset and liability cash flows, intelligent risk managers will utilize debt contracts of varying expected durations to strengthen their balance sheet. For example, a lender's risk manager may seek multiple classes of debt instrument, reflecting multiple prepayment profiles, in order to assure himself of adequate incoming cash flow to sustain his expected liability cash outflows. In the matching, therefore, of expected cash in- and out-flows, the prudent risk manager utilizes a carefully segmented portfolio of debt instruments scored by prepayment propensities (and other measures) and priced accordingly, to avert liquidity crises.

- [20] An additional, equally valuable use of the present invention is in the valuation of existing mortgage or debt instrument blocks of business. This valuation may be required by lender risk managers, auditors, regulators, or investors; it may reflect stakeholder interest in actively managing asset-liability risk, or it may be performed as part of the merger and acquisition appraisal. In all instances, the prepayment scoring system quantifies from a granular perspective upward to a pool, or block perspective, the prepayment speed characteristics of the debt instruments. As we have seen in the Green Tree case, failing to adequately price prepayment risk has enormous balance sheet implications, and typically leads one to grossly over value a portfolio or the enterprise itself.
- [21] For auditors, the system of the present invention offers a quantitative measure of prepayment risk thus reducing auditor exposure to "claw-back" write-downs. This situation occurs in the case of issuers that secure these mortgages and, under the generally applied accounting procedures (GAAP) accelerate and capture earnings based on certain prepayment assumptions. If those prepayment assumptions are incorrect, prior year financial statements are incorrect and massive charges are required to reflect lower portfolio earnings.
- [22] For banking regulators, the system of the present invention offers the ability to quantify balance sheet risk resulting from expected consumer prepayment behavior. This will allow regulators to more precisely measure and assign minimum bank capital levels.
- [23] For credit rating agencies, the ability to score according to an objective, standard

methodology prepayment risk provides enormous assistance in rating a lender's creditworthiness. Rating agencies function, effectively, as credit market bellweathers. Lending institutions are dependent on favorable credit ratings in order to float their institutional debt at advantageous rates; rating agencies, as in the case of regulators, evaluate carefully lenders' claims of capital adequacy; the capital (cash reserves) retained by lenders is directly and immediately affected by debt instrument prepayment speeds. This is because, under GAAP accounting rules, lenders are allowed to capture a substantial percentage of the future expected profits for a given contracted debt instrument, and those profits are themselves substantially dependent on the assumed life of the instrument. (In the case of subprime mortgages, for example, profits may double if the mortgage is maintained in force for four years instead of three). If those profits are overstated, they must be reversed, with resultant charges reducing lender capital (capital: paid-in cash investments plus retained profits). Therefore, rating agencies must scrutinize lender portfolio prepayment speed assumptions, because if those assumptions prove false, then the lender will suffer a reduction in capital. Any significant impairment of lender capital necessarily suggests a reduction in its credit rating. Credit rating agencies will be major beneficiaries and users of the present invention.

[24] For investment bankers, the system of present invention establishes a standardized prepayment methodology that allows merger and acquisition advisers to be able to quantitatively measure the balance sheet risk in a target banking or mortgage company. In addition, investment bank usage of the present invention will include its application to debt instrument securitization. Securitization describes the process

by which pools of mortgage or other debt instruments are purchased by investment banks-in their capacity as underwriters-and re-sold to institutional and public investors as reconstituted securities. Typically, these securitizations benefit originators of debt, because they realize significant acceleration in realized profits; they also significantly diversify their risks by selling significant aspects of the debt instrument to asset underwriters and others. However, the typical debt instrument securitization proceeds with the originating lender retaining significant prepayment risk; if prepayment speeds accelerate beyond levels assumed in the securitization pricing process, the originating lender is held responsible. Hence the invention, by measuring the expected prepayment behavior and scoring in according to an accepted, industry standard method, will improve the securitization process and render it more efficient. Once again, this will reduce costs for all participants and free up more capital for lower-cost consumer borrowing.

[25] For investors, the method of the present invention provides a way to make investment decisions based upon quantified debt instrument prepayment behavior risk for lending institutions in which investors might want to invest, or to evaluate the relative stability of mortgage securities that are backed by individual debt instruments.

[26] These and other advantages of the present invention are described in reference to the specification that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

[27] Figure 1 is an overview of the process of the present invention.

- [28] **Figure 2** is a block diagram of the present invention.
- [29] **Figure 3** is a block diagram showing the user interface module connections.
- [30] **Figure 4** is block diagram showing the interactions with the prepayment historical data.
- [31] **Figure 5** is a block diagram showing the interactions with the econometric model.
- [32] **Figure 6** is a block diagram showing the factors that are used by the user interface module.

DETAILED DESCRIPTION OF THE INVENTION

- [33] Referring to **Figure 1**, an overview of the process of the present invention is shown. The mortgage broker or lending institution first obtains a loan application from a borrower **10**. That information is electronically transmitted to the present invention, which parses the information **12** of the loan application into various categories that are relevant to the scoring of the potential loan. The loan application contents are parsed based upon the information needs of a sophisticated, mathematical model resident in the present invention. A prepayment score is then derived **14** for the particular consumer as a function of the particular loan type being requested, and in further view of the interest rate environment in which the loan is being processed (i.e. rising or falling interest rates). As previously noted this score is an indication of the prepayment propensity of a particular consumer. The prepayment score is then returned to the lender **16**. Thereafter the lender can create a customized loan product that rewards favorable prepayment behavior of the

consumer 18.

- [34] Referring to **Figure 2**, an overview of the system of the present invention is shown. A loan originator **20** receives the application from a potential consumer. That application is then input to the loan originator's data delivery channels **22**. Such data delivery channels **22** are (without limitation) e-mail, fax, Internet, and generally other electronic means. Other loan originators **34** also send their respective consumer applications over their own data delivery channels **36**.
- [35] The present invention anticipates delivery of loan applications **24** over the Internet **28** or other digital electronic means such as wireless communications methods as well. Electronic loan applications **40** enter the system of the present invention through a communication server **42**. The loan information concerning a given consumer is then submitted to an application parser **52**. Application parser **52** divides the information into loan information **58** and applicant information **56**. Loan information **58** is information that relates to the amount, the term, down payment, loan type, and other information important and relating to the amount of money to be loaned. Applicant information **56** is information such as name, address, Social Security number, and other demographic information concerning the applicant.
- [36] Loan information **56** is fed into a prepayment model library database **66**. The prepayment model library database **66** comprises information concerning prepayment historical data **62**. The results are fed into model training server **64** which processes prepayment historical data **62** of both an individual and demographic groups which in turn provides updates to the model library database **66**.

Once loan information 58 is processed by the prepayment model library database 66 an analytical prepayment model 60, which is based upon the loan information 58 is provided to the prepayment calculation server 46. Prepayment calculation server 46 receives additional information from econometric model 48 which establishes the relationship among the wide variety of variables. Econometric model 48 generates interest rate, mortgage rate and other economic parameters that, arrayed in time series, comprise scenarios utilized by the prepayment calculations server. These scenarios are generated from the Low Discrepancy Sequence (LDS) logic, rather than using random number generation. The LDS logic affords significantly higher model accuracy with the same number of scenarios.

[37] Once a prepayment score 44 is derived by prepayment calculation server 46, prepayment score 44 is sent to the communication server 42 and is transmitted over the Internet (or other electronic channels) 28 through the data delivery channels 22 or 36 back to loan originators 20 or 34 who can then either approve, disapprove, or create customized loan product for the consumer.

[38] Prepayment score 38 is calculated based upon the following model. The specific prepayment analysis of the present invention is conceptually shown below.

[39] The following variables:

[40] $A = (a_1, a_2, \dots, a_n)$

[41] $L = (l_1, l_2, \dots, l_m)$

[42] are vectors of the applicant's data and loan parameters.

[43] $E_s(t) = (e_{1s}(t), e_{2s}(t), \dots, e_{ks}(t)); \quad s = 1, \dots, S$

[44] denotes a set of Low Discrepancy Sequence (LDS)-based scenarios of the econometric parameters, which have been generated by the RTH Linked Index Econometric Model. Thus the model is a set of stochastic differential equations that describe the dynamics and interaction of major macroeconomic indicators, each relevant to the prepayment propensity calculation.

[45] Analytical Prepayment Model \mathfrak{R} , which varies with the types of loan applied for, is trained to calculate prepayment value p_s in a given scenario based on the applicant's data (A), loan parameters (L), and econometric parameters (E):

$$p_s(t) = \mathfrak{R}(A, L, E_s(t))$$

[46] Total prepayment, accumulated by the time T in scenario s , can be calculated as:

$$P_s(T) = \prod_i p_s(t_i)$$

[47] Then, total prepayment at time T is given by:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

[48] Finally, the prepayment score is:

$$Score = \sum_T TP(T)$$

[49] The analytical model that produces the prepayment score may be further informed

by additional external behavioral or econometric factors, based on subsequent research, as well as the aforementioned behavioral scoring of mortgage broker behavior.

[50] The present invention may also be represented in an alternative embodiment in the form of the credit engineering workstation (CEW). This CEW (more fully described below) comprises a user interface which allows a loan originator to conduct all of the prepayment calculations, model analysis, and pricing of the present invention using the prepayment model first noted above.

[51] The CEW operates in either a Unix or Windows NT environment using Oracle, SQL server, Sybase, DB2, or Informix database support. The CEW also uses CORBA or, structured object models together with a JAVA/HTML browser based graphical user interface.

[52] The subroutines of the CEW all contribute to the end goal of determining the prepayment propensity of a consumer. For example, subroutines of the present invention deal supports the generation of various interest rate scenarios, and subsequent economic scenarios model fitting processes that fit the modeled interest rates scenarios to historical and current interest rate yield curve performance as well as to other macro economic indicators.

[53] Part of the system includes rewards pricing logic to efficiently measure and price the impact of rewards on consumer prepayment behavior. For example it would be most beneficial to a lender to reward the consumer for not prepaying the lender's loan. Such a reward could be assessed in terms of its impact on the consumer

prepayment behavior. The system therefore permits the end-user to design pro forma rewards structures and to test their impact on prospective consumer prepayment behavior.

- [54] Various user definable screens also establish default spreads, prepayment spreads, broker commission schedules, and other financial factors that influence the pricing of the product to be offered to the consumer. Various other economic scenarios are collected via the user interface and combined with various probabilities and default data as well as other lender defined criteria result in rationally priced end-user mortgage contracts.
- [55] Referring to **Figure 3**, further information concerning the CEW of the present invention shown. The system comprises user interface module **70** which is the basic graphical user interface and other software that allows an originator to provide information concerning a consumer who wishes to borrow money from lender. The user interface module allows the collection of loan attributes **76**, applicant attributes **74**, and reward program attributes **72**. In addition user interface module **70** collects or calculates spreads, broker commissions and other costs associated with the loan **78**. Loan attributes **76** and other loan related costs are fed into pricing engine **84** which, with other information, assists in creating an appropriate loan price **86**.
- [56] Loan attributes **76**, applicant attributes **74**, and reward program attributes **72** all which have an impact on the value of the loan are fed into prepayment calculation server **80**. Prepayment calculation server **80** receives input from the various prepayment model parameters and creates prepayment score **82**.

- [57] Referring to **Figure 4**, a block diagram showing the interactions which are necessary to create a prepayment model are shown. Consumer information **96** which consists of applicant attributes **74** and loan attributes **76** are fed into a prepayment model fitting **92** module. Prepayment model fitting **92** establishes various prepayment model parameters **94** based upon prepayment historical data **90**. Once the appropriate prepayment model is created by prepayment model fitting **92**, a model is returned to the prepayment calculation server for the calculation of the prepayment score of the particular consumer given the type of loan to consumer is requesting. The prepayment calculation server also benefits from input from an econometric model scenario generator.
- [58] Referring to **Figure 5**, the interactions for the econometric model are shown. Econometric model scenario generator **106** receives input from econometric model fitting module **104** and LDS scenarios **108**. Econometric model fitting module **104** receives information from econometric historical data **100** and current market environment **102** which comprises, without limitation, information concerning rising or falling interest rates and trends. The information from econometric historical data **100** concerns the demographic group to which the consumer belongs and other econometric information such as age, income, credit rating, occupation and other factors. The information from current market environment **102** concerns the direction and velocity of changes to interest rates. Econometric model scenario generator **106** processes the information and produces various scenarios based on the information.
- [59] Referring again to **Figure 3**, prepayment calculation server **80** creates prepayment score **44** for the particular consumer in question. Prepayment score **44** is based upon

the established prepayment model and the generated econometric model.

Prepayment score **44** is transmitted to the pricing engine **82** to establish the pricing of the loan product to be offered to the consumer in question.

[60] Referring to **Figure 6**, additional parameters which the user interface module uses to create the various scenarios are shown. Additional aspects of the present invention provide for creation of new products. Strategy optimizer **122** is based upon acceptance of offered products by consumers and input from and relating to other products are on the market. Strategy optimizer **122** generates marketing plans based upon individual lenders' portfolios. Such a market plan could assist the lender in offering new products to the marketplace that are more profitable for the lender. The system includes targeting optimizer **124** which provides a way to offer loan products to those consumers having the most favorable prepayment characteristics, i.e., a low propensity to prepay loans made. The system also comprises loyalty optimizer **126** which models and defines offers and other inducements to consumers to reward financially advantageous consumer behavior. Channel optimizer **128** is part of the present invention. Channel optimizer **128** analyzes the channels of delivery of financial product offerings to evaluate and determine the channel that is the most efficient way to deliver various financial products. The system also comprises database optimizer **130** which receives and organizes information in the various databases to constantly build and refined prepayment historical data **90** and econometric historical data **100**.

[61] The target platform on which the system of the present invention will run is either an Intel Pentium processor based system with typically 32 megabytes of RAM, hard

disk storage and retrieval, and communications capability using the TCP/IP protocol. Alternatively the system will also run under the UNIX operating system on a Sun Solaris platform. In both cases displays for users are anticipated as is the ability to output hard copy reports. In typical operation, a plurality of users, remote from the system site will access the system via private networks or over the Internet to send the information necessary for the present invention to make the desired calculations leading to the prepayment score. This score is then sent back to the requesting user at the remote terminal.

[62] Although described herein with respect to a mortgage loan or loan, the present invention is applicable to numerous financial instruments that have a value that depends on the particular consumer's actions over time. The value of typical debt instruments, such as, but not limited to, mortgages, second mortgages, home equity loans, car loans, school loans, term loans, leases, credit card accounts, and credit card balance transfers, depend on a continued stream of cash and are therefore affected significantly by prepayment.

[63] The value of other instruments that depend on the cash stream over time, such as open-end car leases and whole-life insurance policies, can also depend on the consumer's actions, and therefore, for purposes of this invention can be considered as a form of debt instrument. In the car lease scenario, predicting the probability of a consumer electing to purchase or return the car before the end of the lease (prepay) is important in determining the value of the lease. Even a consumer's predisposition to keeping (purchasing at residual value price, a type of prepayment) or returning the car at the end of the lease can be used to modify the lease terms to the leasing entity's

advantage.

- [64] Likewise, the likelihood of a consumer to cash out the surrender value of a whole-life insurance policy (another form of prepayment, albeit in the opposite direction, that ends the stream of cash) can significantly affect the ultimate value of the policy to the insurer.
- [65] Known database and computer-based data mining techniques can be used for analyzing: the value of financial instruments (and portfolios in which they are packaged) based on the prepayment score associated with each of them; the risk associated with portfolios containing the financial instruments; and the pricing for servicing those portfolios. Additionally, instruments can be packaged together into portfolios based, at least in part, on the prepayment scores of the applicants.
- [66] A system and method for prepayment score generation has been described. Those skilled in the art will appreciate that other variations of the present invention are possible without departing from the scope of the invention as described.

WHAT IS CLAIMED IS:

[c1] A system for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:

at least one debt instrument origination computer terminal for accepting and transmitting a debt instrument application of an individual applicant;

a computer network connected to the at least one debt instrument origination computer terminal for receiving the transmitted debt instrument application of the individual applicant;

a communication server connected to the computer network for receiving the transmitted debt instrument application of the individual applicant;

an application parser connected to the communications server for receiving the transmitted debt instrument application of the individual applicant from the communications server and parsing the information into debt instrument information and applicant information;

a prepayment model library database comprising debt instrument prepayment models connected to the application parser for receiving the debt instrument information and fitting the debt instrument information into the debt instrument prepayment models and for transmitting debt instrument prepayment models that match the debt instrument information; and

a prepayment calculation server comprising a prepayment score generation model connected to the prepayment model library database for receiving the debt instrument

prepayment models and calculating a prepayment score for the debt instrument application of the individual applicant based upon the debt instrument prepayment model and the prepayment score generation model, the prepayment calculation server being further adapted to transmit the prepayment score to at least one debt instrument origination computer terminal via the communications server and the computer network;

where the prepayment score is calculated from the formula:

$$Score = \sum_T TP(T)$$

where T represents time and P represents prepayment; and

wherein the at least one debt instrument origination computer terminal is adapted to use the prepayment score to adjust terms of the debt instrument of the individual applicant.

[c2] The system for determining a prepayment score of claim [c1], where the prepayment model library database further comprises:

a model training server for creating the debt instrument prepayment models for the prepayment model library database; and

prepayment historical data storage means connected to the model training server, the prepayment historical data further comprises prepayment statistics regarding debt instruments of various types.

[c3] The system for determining a prepayment score of claim [c1], where the prepayment calculation server further comprises an econometric model that

generates Low Discrepancy Sequence (LDS)-based scenarios of econometric parameters for input to the prepayment calculation server.

- [c4] The system for determining a prepayment score of claim [c1], further comprising means adapted to calculate a total prepayment at time T from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

- [c5] The system for determining a prepayment score of claim [c4], further comprising means adapted to calculate the total prepayment, accumulated by time, in scenario s from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

- [c6] The system for determining a prepayment score of claim [c5], further comprising means adapted to calculate the prepayment value in a given scenario from the formula:

$$p_s(t) = \Re (A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \Re is an analytical prepayment model.

- [c7] The system for determining a prepayment score of claim [c1], where the applicant is either an individual consumer or an individual household.
- [c8] The system for determining a prepayment score of claim [c1], further comprising computer-based means for using data associated with the prepayment score of the applicant and terms of the debt instrument to determine a calculation selected from the group consisting of: a value of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.
- [c9] A method for determining a prepayment score representative of prepayment propensity of an individual applicant, comprising:
- collecting debt instrument and applicant information at a debt instrument originator;
 - transmitting the debt instrument and applicant information over a network;
 - receiving the debt instrument and applicant information at a service bureau;
 - the service bureau calculating a prepayment score the individual applicant, where the prepayment score is calculated from the formula:
- $$Score = \sum_T TP(T)$$
- where T represents time and P represents prepayment;
 - the service bureau returning the prepayment score over the network to the debt

instrument originator; and

the debt instrument originator using the prepayment score to customize a debt instrument product for the individual applicant.

[c10] The method for determining a prepayment score of claim [c9], where calculating a prepayment score for the applicant comprises parsing the information into debt instrument information and applicant information.

[c11] The method for determining a prepayment score of claim [c10], further comprising providing the applicant information to a prepayment model library database and the debt instrument information to a prepayment calculation server.

[c12] The method for determining a prepayment score of claim [c11], further comprising the prepayment model library determining the prepayment model that best applies to the debt instrument information and providing that prepayment model to the prepayment calculation server.

[c13] The method for determining a prepayment score of claim [c12], further comprising the prepayment calculation server receiving a prepayment model and an econometric model, where the prepayment calculation server further calculates a prepayment score for the applicant.

[c14] The method for determining a prepayment score of claim [c13], where the total prepayment at time T is calculated from the formula:

$$P(T) = (1/S) \sum_{s=1}^S P_s(T)$$

where S represents the number of scenarios and P represents the prepayment amount for a given scenario.

[c15] The method for determining a prepayment score of claim [c14], where the total prepayment, accumulated by time, in scenario s is calculated from the formula:

$$P_s(T) = \prod_i p_s(t_i)$$

where p(t) is a prepayment value.

[c16] The method for determining a prepayment score of claim [c15], where the prepayment value in a given scenario is calculated from the formula:

$$p_s(t) = \Re(A, L, E_s(t))$$

where A is the applicant's data, L is the debt instrument parameters, E is the economic parameters and \Re is an analytical prepayment model.

[c17] The method for determining a prepayment score of claim [c9], where the applicant is defined as an individual consumer or an individual household.

[c18] The method for determining a prepayment score of claim [c9], further comprising rating a broker based on prepayment scores of applicants that are clients of said broker.

[c19] The method for determining a prepayment score of claim [c9], further comprising using the prepayment score of the applicant and terms of the debt instrument to assist in determining a calculation selected from the group consisting of: a value

of the debt instrument, a value of a portfolio containing the debt instrument, a risk to holders of the debt instrument, and a price of a servicing contract for a portfolio containing said debt instrument.

[c20] The method for determining a prepayment score of claim [c9], further comprising packaging said debt instrument into a portfolio based, at least in part, on the prepayment score of the applicant.

Abstract of the Disclosure

A method and apparatus is disclosed for determining the prepayment propensity of individual borrowers. Early payment of debt instruments, such as loans and leases, can lead to losses being suffered by lenders. The present invention analyzes the demographics associated with a particular borrower to determine both the individual and group based prepayment propensity. The history of the borrower, the history of the borrower's demographic group, interest rate trends and other factors are then used to calculate a prepayment score that can be used by the lender to determine the propensity of a given borrower to prepay the instrument in question. The score of the individual borrower can be used to estimate the profitability of a debt instrument and allow the lender to make appropriate adjustments prior to issuing the instrument. The individual prepayment scores of a lender's or broker's clients can also be used to rate the lender or broker.

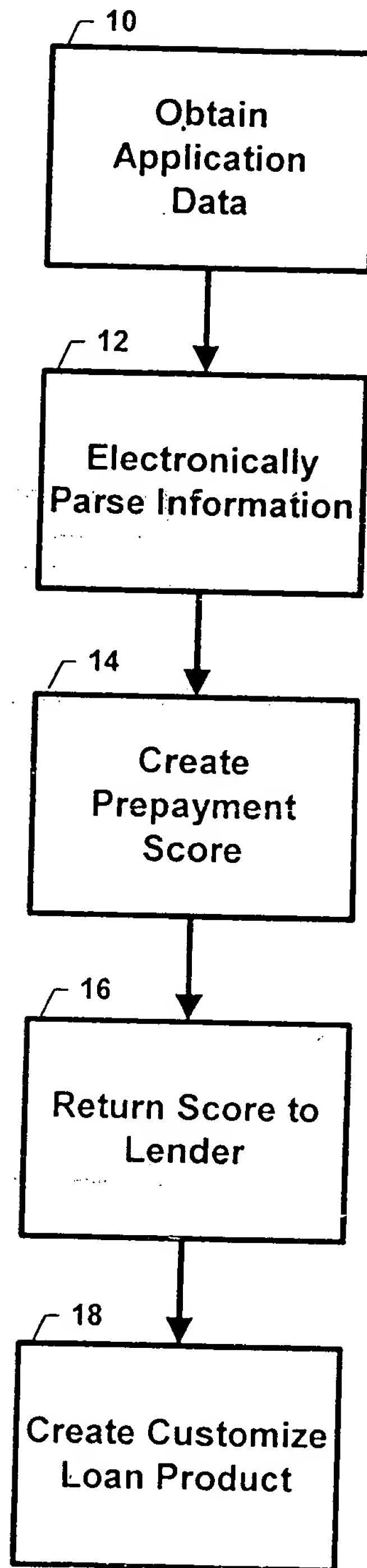


FIGURE 1

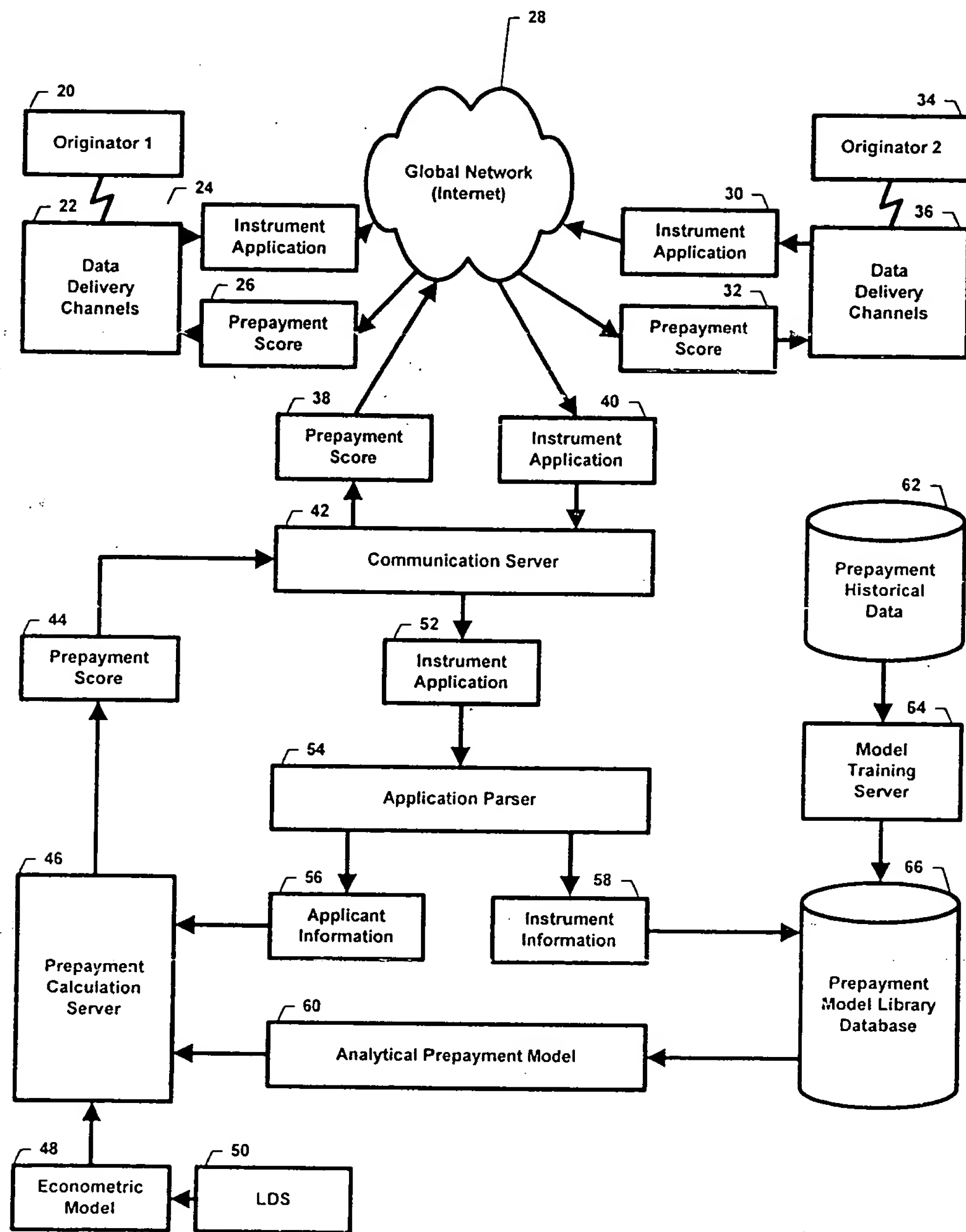


FIGURE 2

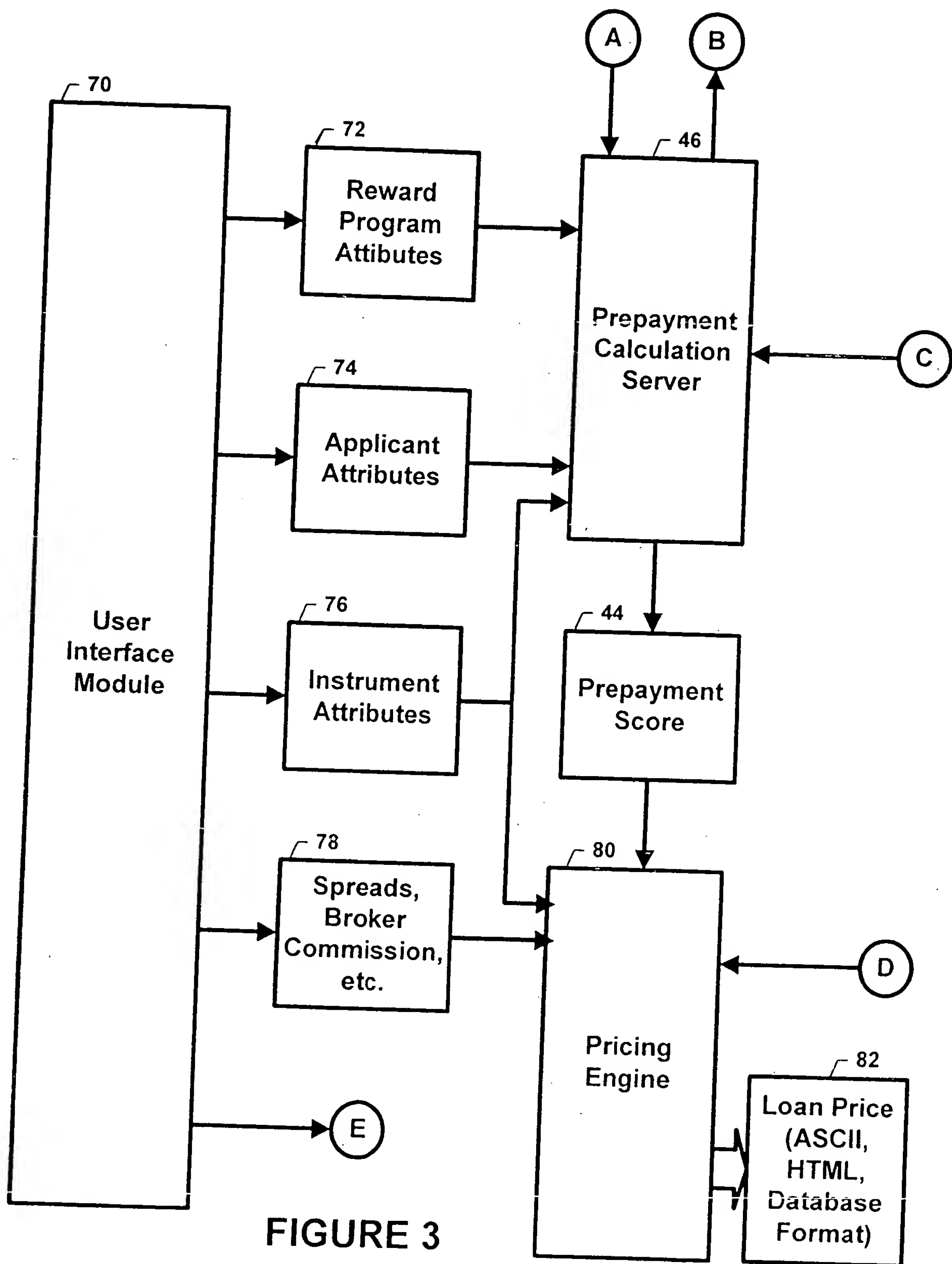


FIGURE 3

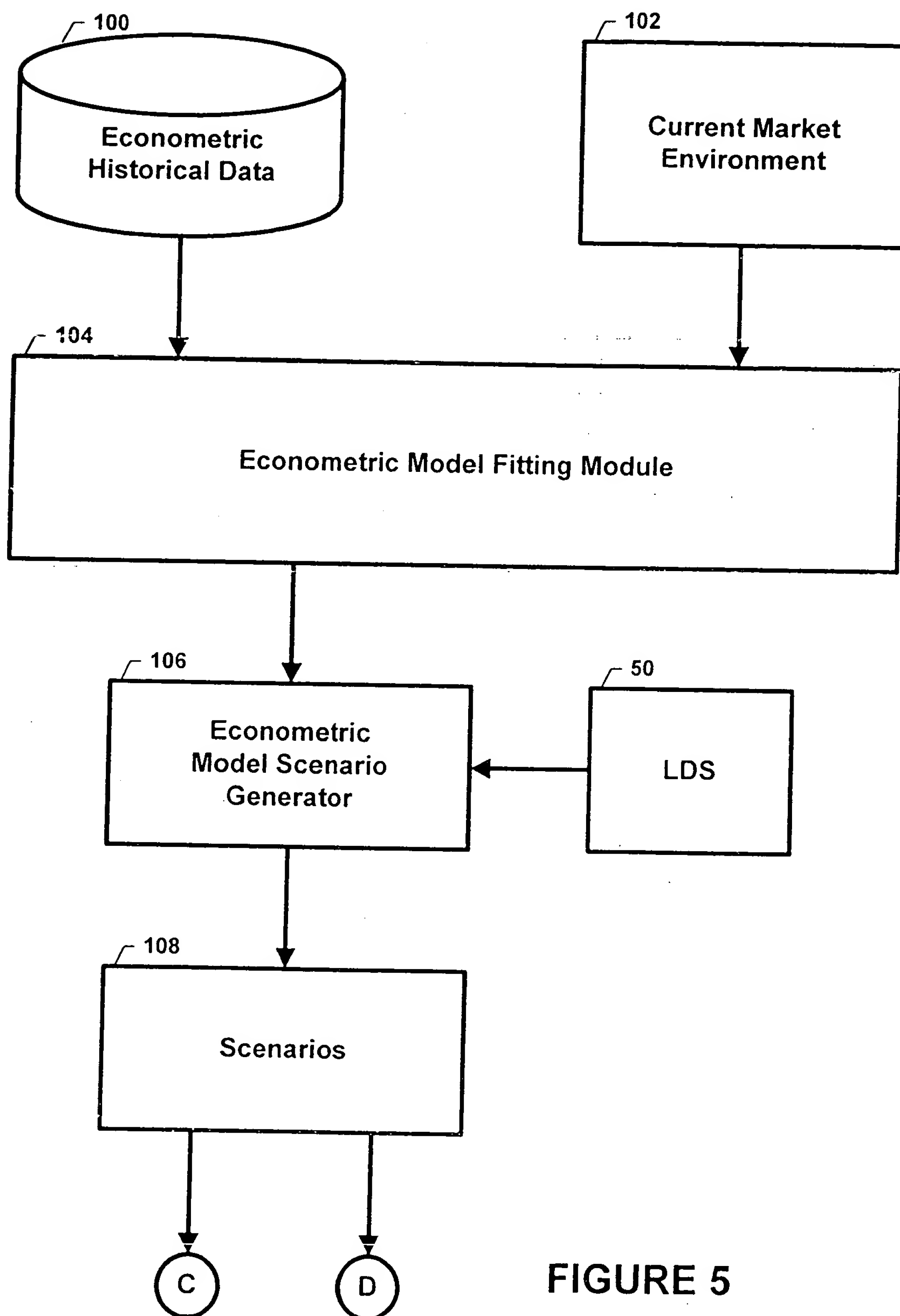


FIGURE 5

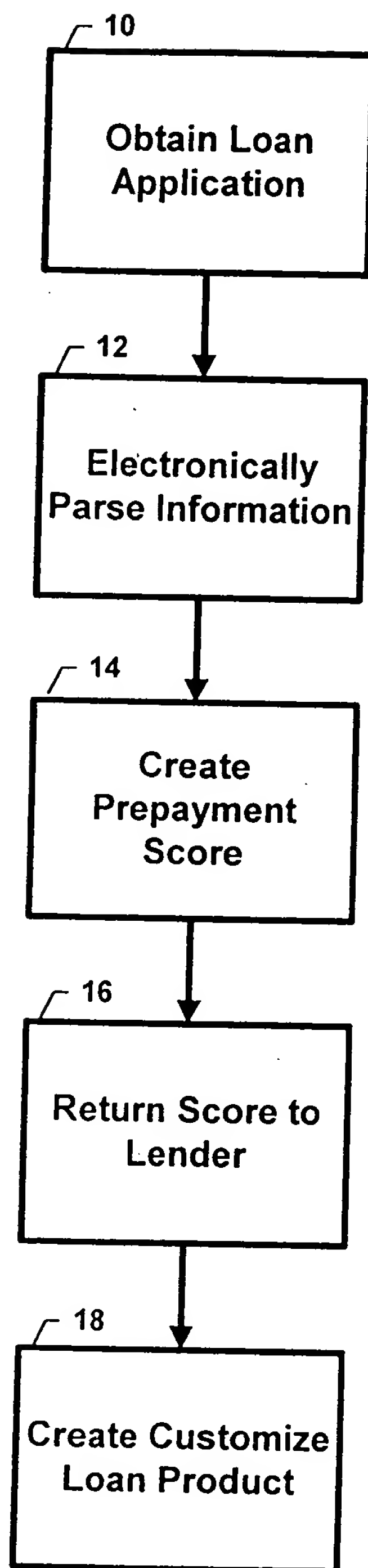


FIGURE 1

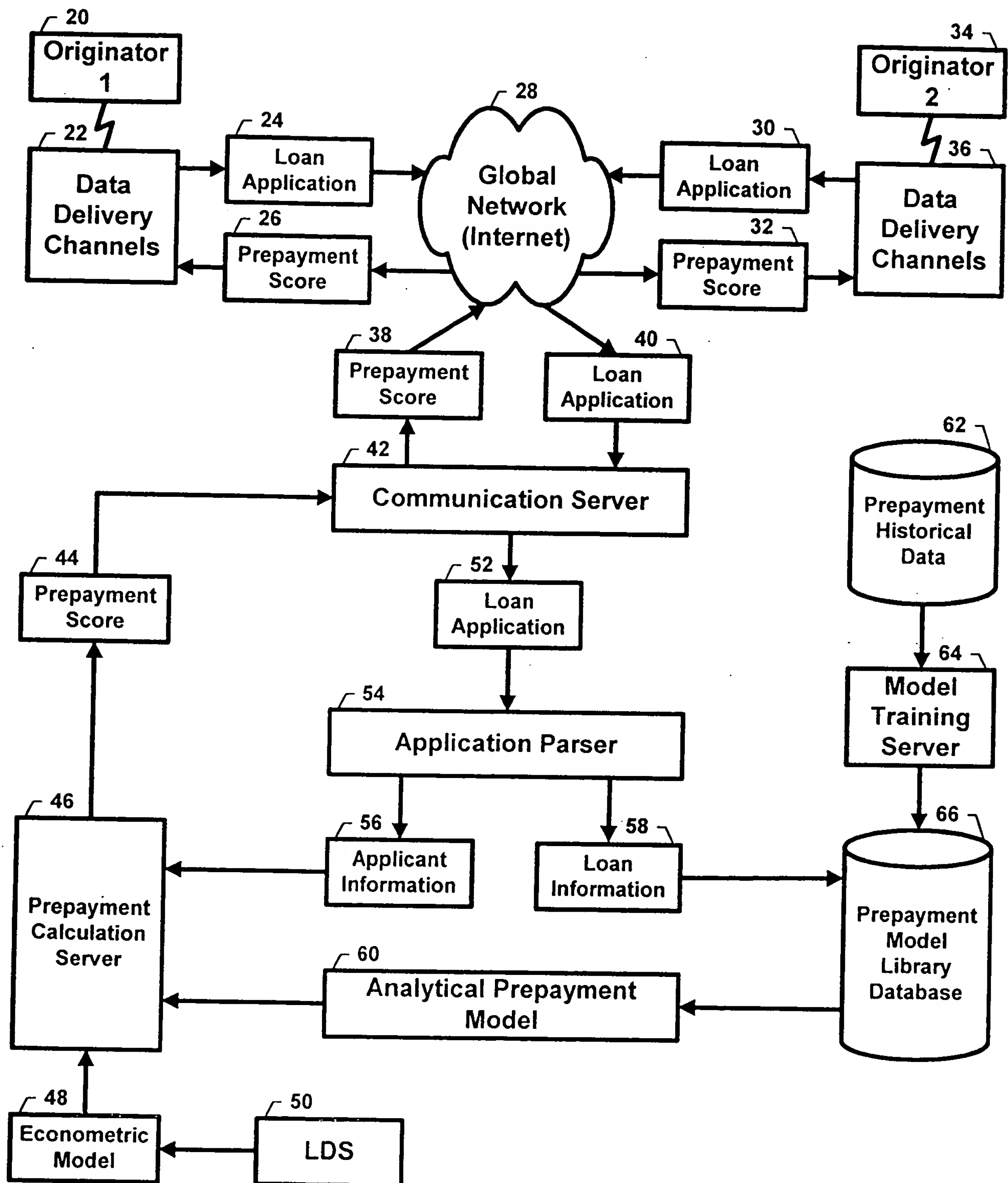


FIGURE 2

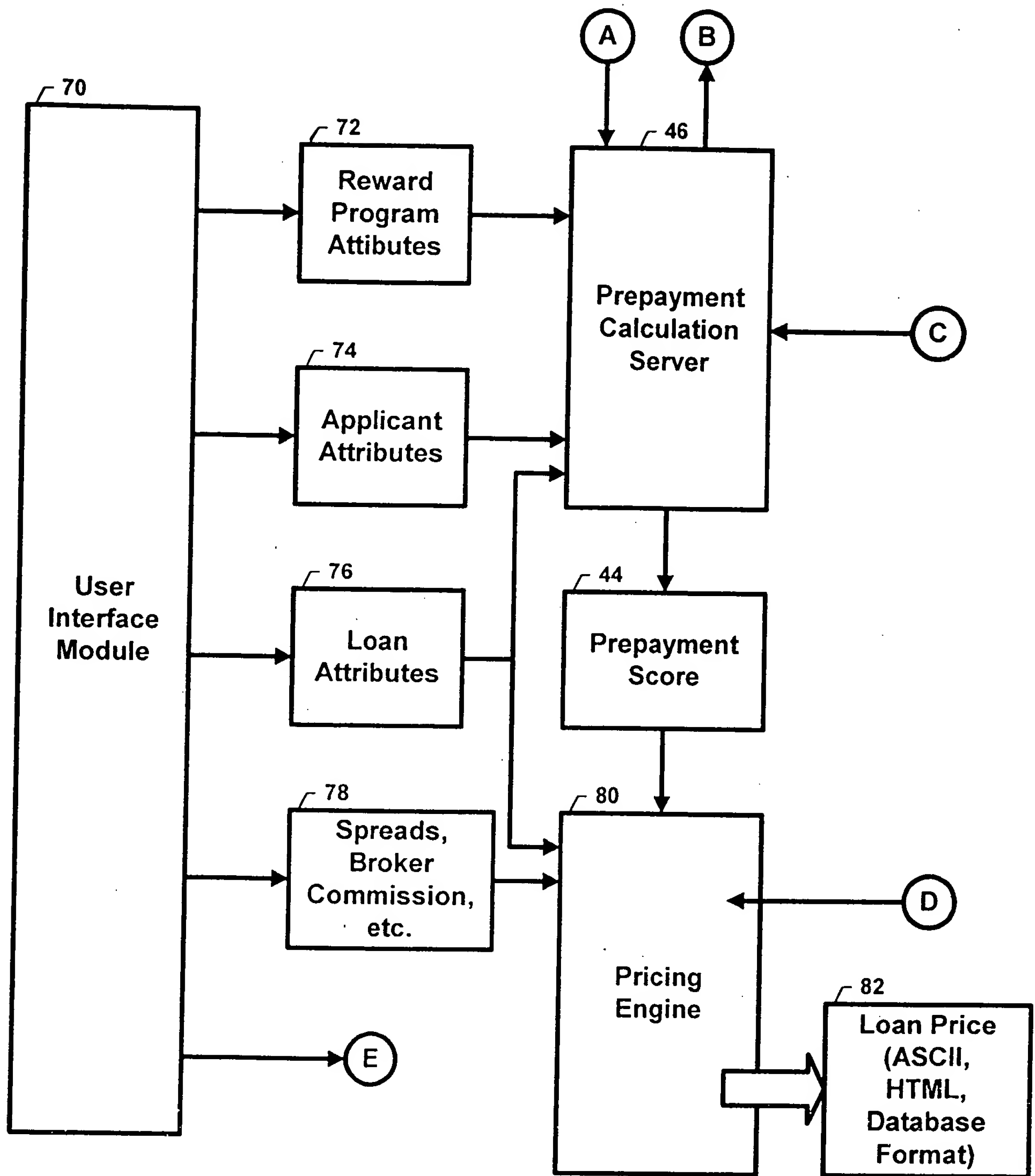


FIGURE 3

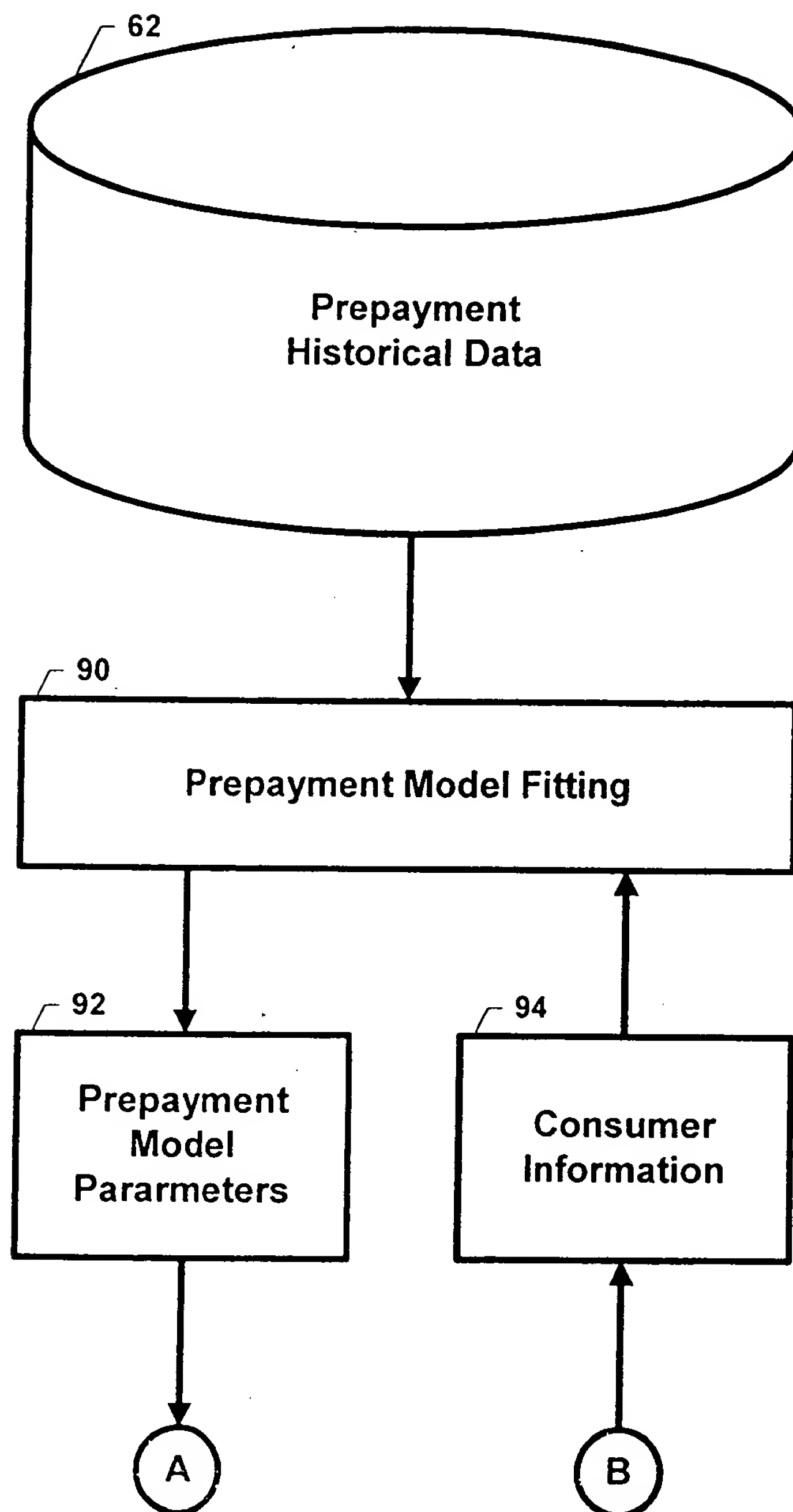


FIGURE 4

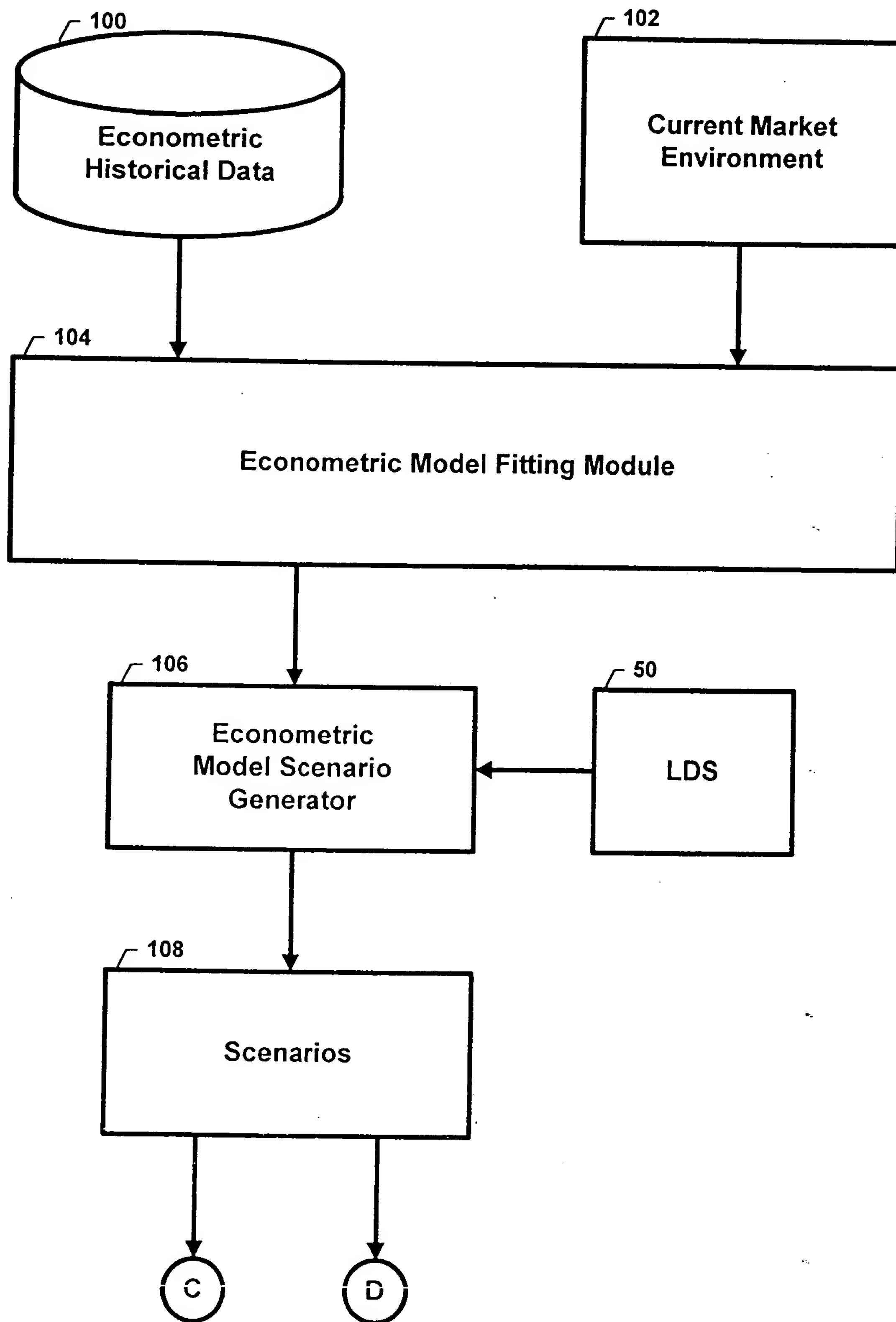


FIGURE 5

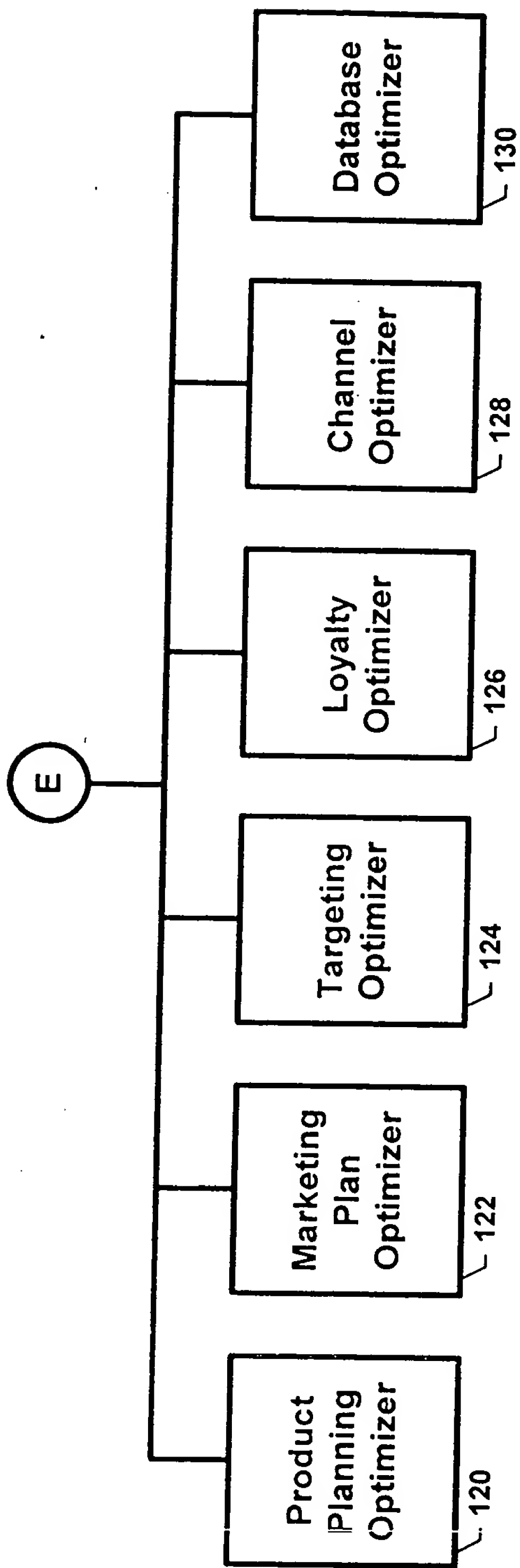


FIGURE 6

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Yuri Galperin, et.al.
Appl. No. : 09/942,983
PCT Filing Date : August 30, 2001
For : METHOD AND APPARATUS
FOR DETERMINING A
PREPAYMENT SCORE FOR AN
INDIVIDUAL APPLICANT
Examiner : Siegfried E. Chencinski
Group Art Unit : 3692

STATEMENT OF CHARLES L. JONES III UNDER 37 C.F.R. § 1.48(a)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Charles L. Jones III, do declare as follows:

1. I am a citizen of the United States and reside at _____.
2. The above-referenced patent application was filed on August 30, 2001 listing Yuri Galperin, Vladimir Fishman and William A. Eginton as the joint inventors.
3. I believe that I, Charles L. Jones III, should also be named as an inventor in the above-referenced application.
4. The inventorship error occurred without deceptive intent on my part.

I declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful, false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful, false statements may jeopardize the validity of the application or document, or any registration resulting therefrom.

Dated: _____

Charles L. Jones III

ASSIGNMENT

WHEREAS, I, Charles L. Jones III, residing at _____, am a joint inventor, along with Yuri Galperin, Vladimir Fishman, and William A. Eginton, of certain new and useful improvements in a METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT for which we have filed an application for Letters Patent in the United States, Application No. 09/942,983 Filed on August 30, 2001;

AND WHEREAS, MarketSwitch Corporation (hereinafter "ASSIGNEE"), a Delaware corporation, with its principal place of business at 2350 Corporate Park Drive, Suite 400, Herndon, VA 20171, desires to acquire the entire right, title, and interest in and to said improvements and said Application:

NOW, THEREFORE, in consideration of the sum of One Dollar (\$1.00) to me in hand paid, and other good and valuable consideration, the receipt of which is hereby acknowledged, I, said inventor, do hereby acknowledge that I have sold, assigned, transferred and set over, and by these presents do hereby sell, assign, transfer and set over, unto said ASSIGNEE, its successors, legal representatives and assigns, the entire right, title, and interest throughout the world in, to and under said improvements, and said application including all provisional applications relating thereto (including but not limited to U.S. Provisional Application No(s). 60/228,954, filed August 31, 2000 (respectively if plural applications)), and all divisions, renewals and continuations thereof, and all Letters Patent of the United States which may be granted thereon and all reissues and extensions thereof, and all rights of priority under International Conventions and applications for Letters Patent which may hereafter be filed for said improvements in any country or countries foreign to the United States, and all Letters Patent which may be granted for said improvements in any country or countries foreign to the United States and all extensions, renewals and reissues thereof; and I hereby authorize and request the Commissioner of Patents of the United States, and any Official of any country or countries foreign to the United States, whose duty it is to issue patents on applications as aforesaid, to issue all Letters Patent for said improvements to said ASSIGNEE, its successors, legal representatives and assigns, in accordance with the terms of this instrument.

AND I DO HEREBY sell, assign, transfer, and convey to ASSIGNEE, its successors, legal representatives, and assigns all claims for damages and all remedies arising out of any violation of the rights assigned hereby that may have accrued prior to the date of assignment to ASSIGNEE, or may accrue hereafter, including, but not limited to, the right to sue for, collect, and retain damages for past infringements of said Letters Patent before or after issuance.

AND I HEREBY covenant and agree that I will communicate to said ASSIGNEE, its successors, legal representatives and assigns, any facts known to us respecting said improvements, and testify in any legal proceeding, sign all lawful papers, execute all divisional, continuing and reissue applications, make all rightful oaths and generally do everything possible to aid said ASSIGNEE, its successors, legal representatives and assigns, to obtain and enforce proper patent protection for said improvements in all countries.

IN TESTIMONY WHEREOF, I hereunto set my hand and seal this ____ day of _____, 20__.

Charles L. Jones III

STATE OF }
 } ss.
COUNTY OF }

On _____, before me, _____, notary public, personally appeared **Charles L. Jones III** personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is/are subscribed to the within instrument, and acknowledged to me that he executed the same in his authorized capacity(ies), and that by his signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

[SEAL]

Notary Signature

DECLARATION - USA PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, mailing address and citizenship are as stated below next to my name;

I believe I am an original, first and joint inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **METHOD AND APPARATUS FOR DETERMINING A PREPAYMENT SCORE FOR AN INDIVIDUAL APPLICANT**; the specification of which was filed on August 30, 2001 as Application Serial No. 09/942,983.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above;

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56;

I hereby claim the benefit under Title 35, United States Codes § 119(e) of any United States provisional application(s) listed below.

Application No.: 60/228,954

Filing Date: August 31, 2000

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of first inventor: **Yuri Galperin**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Second inventor: **Vladimir Fishman**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Third inventor: **William A. Eginton**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: USA

Mailing Address: same as above

Full name of Fourth inventor: **Charles L. Jones III**

Inventor's signature _____

Date _____

Residence: _____

Citizenship: _____

Mailing Address: same as above

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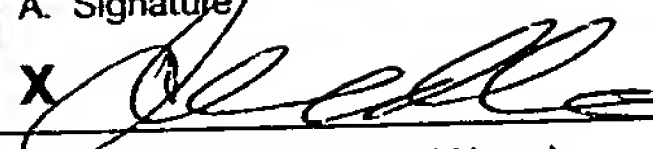
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